AD-A272 093



U.S. ARMY MATERIEL COMMAND - COMMITTED TO PROTECTION OF THE ENVIRONMENT -

LIMML

CONTAMINATION ASSESSMENT REPORT
SANITARY SEWER - RAILYARD AND ADMINISTRATION ARI
VERSION 3.2

August 1988 Contract No. DAAK11-84-D-0017 TASK NO. 10

S DTIC NOV 0 9 1993 A

EBASCO SERVICES INCORPORATED

R. L. Stollar and Associates California Analytical Laboratories, Inc. DataChem, Inc. Geraghty & Miller, Inc.

REQUESTS FOR COPIES OF THIS DOCUMENT
SHOULD BE REFERRED TO THE PROGRAM MANAGER
FOR THE ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP.
AMXRM/ABERDEEN-RROVING GROUND, MARYLAND

This accument has been approved for public release and sale; its distribution is unlimited.

93-27099

ROCKY MOUNTAIN ARSENAL • COMMERCE CITY, COLORADO • 80022-2180

8325.223

LITIGATION TECHNICAL SUPPORT AND SERVICES

ROCKY MOUNTAIN ARSENAL

FINAL

CONTAMINATION ASSESSMENT REPORT
SANITARY SEWER - RAILYARD AND ADMINISTRATION AREAS
VERSION 3.2

DTIC ELECTE NOV 0 9 1993

August 1988 Contract No. DAAK11-84-D-0017 TASK NO. 10

Prepared by:

EBASCO SERVICES INCORPORATED
R.L. STOLLAR AND ASSOCIATES
CALIFORNIA ANALYTICAL JABORATORIES, INC.
DATACHEM, INC. GERAGHTY & MILLER, INC.

Prepared for:

U.S. ARMY PROGRAM MANAGER'S OFFICE FOR ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

THE INFORMATION AND CONCLUSIONS PRESENTED IN THIS REPORT REFRESENT THE OFFICIAL POSITION OF THE DEPARTMENT OF THE ARMY UNLESS EXPRESSLY MODIFIED BY A SUBSEQUENT DOCUMENT. THIS REPORT CONSTITUTES THE RELEVANT POSITION OF THE ADMINISTRATIVE RECORD FOR THIS CERCLA OPERABLE UNIT.

THE USE OF TRADE NAMES IN THIS REPORT DOES NOT CONSTITUTE AN OFFICIAL ENDORSEMENT OR APPROVAL OF THE USE OF SUCH COMMERCIAL PRODUCTS. THE REPORT MAY NOT BE CITED FOR PURPOSES OF ADVERTISEMENT.

This electment has been approved for public release and sale; its distribution is unlimited.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 3704-0188

Profit reporting ourden for this to extind it in the gathering and maintaining the data needed and silection in discretation extuding sudgestions? Causer onway suite 1774 Literagion is A 122224	Completing and reviewing the Collection of the reducing this burden of Mashington H	it intormation lijeng comments re- eadquurters betwees liilrectorate	garding this bu	aden est mate driving lither aspect of this noberations and hebitits (1215) lefferson
1. AGENCY USE ONLY (Leave plans	2. REPORT 08/00/88	3. REPORT TYPE A	NO DATES	COVERED
4-CONTAMANAPION PRESENENT REPOR AREAS, TASK 10, FINAL, VERSION	•	AND ADMINISTRATION	5. FUNC	DING NUMBERS
6. AUTHOR(S)			DAAK11 A	84 D 0017
7. PERFORMING ORGANIZATION NA EBASCO SERVICES, INC.	ME(S) AND ADDRESS(ES)		REPO	ORMING ORGANIZATION RT NUMBER 256R03
9. SPONSORING MONITORING AGEI ROCKY HOUNTAIN ARSENAL (CO.).		(5)		NSORING MONITORING NCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			<u></u>	
12a. DISTRIBUTION AVAILABILITY S	TATEMENT		12b. DIS	TRIBUTION CODE
APPROVED FOR PUBLIC RE	LEASE; DISTRIBUTION	IS UNLIMITED		
WERE ANALYZED FOR VOLAMANALYSES FOR AS, HG, AND WERE DETECTED ABOVE THE BASED ON THE RESULTS STEM ARE CONTAINED INTHE LIFT STATIONS. IF INFORMATION IS NEEDED, BETWEEN MANHOLES 60 AND FROM THESE BORINGS FOR MATERIAL PRESENT IS ESTATED.	ISTRATIVE AREAS. TH 2, 3, 4, 34, AND 35. ORINGS AND 5 SEDIMEN TILE AND SEMIVOLATIL ND TDGCL. DBCP, CLC EIR RESPECTIVE INDIC S OF THE FIELD SURVE N SEDIMENTS WITHIN T THE FEASIBILITY STU THE ADDITIONAL WORK D 61, 2) BORINGS IN DBCP AND CLC2A. TH	T GRAB SAMPLES F E ORGANICS AND M 2A, CD, CR, CU, ATOR RANGES. Y, POTENTIAL CON HE SEWERS AND IN DY DETERMINES TH WILL CONSIST OF THIS AREA, AND 3 E VOLUME OF POTE	DOMEST ROM INS ETALS W ZN, PB, TAMINAN OVERFL AT ADDI 1) EXC) NUMBE	IC SEWAGE FROM IDE MANHOLES ITH SEPARATE AS, AND HG TS IN THIS OW DITCHES AT TIONAL AVATION STUDY R OF SAMPLES
14. SUBJECT TERMS				15. NUMBER OF PAGES
				16. PRICE CODE
17. SECURITY CLASSIFICATION 18 UNCLASSIFIED	B. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIF OF ABSTRACT	ICATION	20. LIMITATION OF ABSTRACT

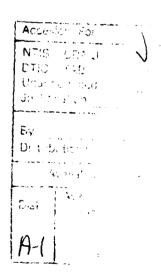
TABLE OF CONTENTS

Section	Fage
EXECUTIVE SUMMARY	
1.0 PHYSICAL SETTING	. 1
1.1 LOCATION AND DESCRIPTION	. 1
1.2 GEOLOGY	. 6
1.3 HYDROLOGY	. 10
2.0 <u>HISTORY</u>	. 11
3.0 FIELD INVESTIGATION	. 12
3.1 PREVIOUS INVESTIGATIONS	. 12
3.2 FIELD SURVEY	. 15
3.2.1 Field Program	. 15
3.2.2 Field Observation	. 21
3.2.3 Geophysical Exploration	. 21
3.2.4 Analyte Levels and Distribution	. 21
3.2.5 Contamination Assessment	. 29
3.3 FOLLOW-ON INVESTIGATIONS	. 32
3.4 QUANTITY OF POTENTIALLY CONTAMINATED MATERIAL	. 35
4.0 REFERENÇES CITED	. 37
Appendix SS-RA-A Chemical Names and Abbreviations	
Appendix SS-RA-B Chemical Data	
Appendix SS-RA-C Comments and Responses	

LIST OF FIGURES

Figure		Page
SS-RA-1	Location Map for the Sanitary Sewer System	2
SS-RA-2a	Location Map for Buildings Connected to Sanitary Sewer in Railyard Area	4
SS-RA-2b	Location Map for Buildings Connected to Sanitary Sewer in Administration Area	5
SS-RA-3	Typical Manhole Configuration	7
SS-RA-4a	Field Boring Profile for Well 04035	8
SS-RA-4b	Field Boring Profile for Well 35051	9
SS-RA-5	Proposed Follow-on Boring Locations	34

DTIC QUALITY INSPECTED 5



LIST OF PLATES (in pocket)

Plate

SS-RA-1 Vicinity Map Showing Manhole and Sampling Locations

SS-RA-2 Topography and Surface Drainage

SS-RA-3 Water Table Elevations and Generalized Groundwater Flow Direction

SS-RA-4 Analytes Detected Within or Above Indicator Levels

LIST OF TABLES

<u>Table</u>		Page
SS-RA-1	Railyard and Administration Area Buildings Connected to the Sanitary Sewer	3
SS-RA-2	Manhole Reconnaissance Survey Observations	17
SS-RA-3	Summary of Analytical Results for Railyard and Administration Area Sanitary Sewer System	22
SS-RA-4	Results of Field Study	23
SS-RA-5	Tentative Identification of Nontarget Compounds	27

EXECUTIVE SUMMARY

SANITARY SEWER - RAILYARD AND ADMINISTRATION AREAS

The sanitary sewer system in the railyard and administration areas is located in the southwestern part of the Rocky Mountain Arsenal in Sections 2, 3, 4, 34, and 35. The sewer system collects domestic sewage from the buildings in these areas and transports it to Manhole 46 in Section 35 where it connects with the sanitary interceptor line. Buildings in the railyard and administration areas have been used primarily by the Army and other federal agencies. This portion of the sanitary sewer system was investigated under Task 10 in the winter and spring of 1986-1987. Twenty manholes were visually inspected to assess the condition of the system and to select sampling sites. A total of 5 borings (3 in manholes and 2 in lift station overflow ditches), yielding 10 samples, were drilled to depths ranging from 5 to 13.5 ft. In addition, 5 sediment grab samples were collected from inside manholes.

The following target analytes were detected within or above their indicator levels: methylene chloride, dibromochloropropane, chloroacetic acid, cadmium, chromium, copper, lead, zinc, arsenic, and mercury. The detection of methylene chloride is attributed to solvent contamination in the laboratory. Lead and arsenic were each detected once within their indicator ranges in the manhole borings and were considered to be consistent with natural levels found in the soils being analyzed. Copper was detected once and mercury was detected twice at elevated levels in borings at the lift station overflow ditches. The sediment grab samples contained low levels of dibromochloropropane and concentrations of chromium, copper, lead, zinc, mercury, and chloroacetic acid above their indicator levels.

Based upon the results of the field survey, potential contaminants in this system are contained in sediments within the sewers and in the overflow ditches at the lift stations; therefore, no follow-on investigation is planned. The estimated volume of potentially contaminated material is 640 cubic yards.

CONTAMINATION ASSESSMENT REPORT

SANITARY SEWER - RAILYARD AND ADMINISTRATION AREAS

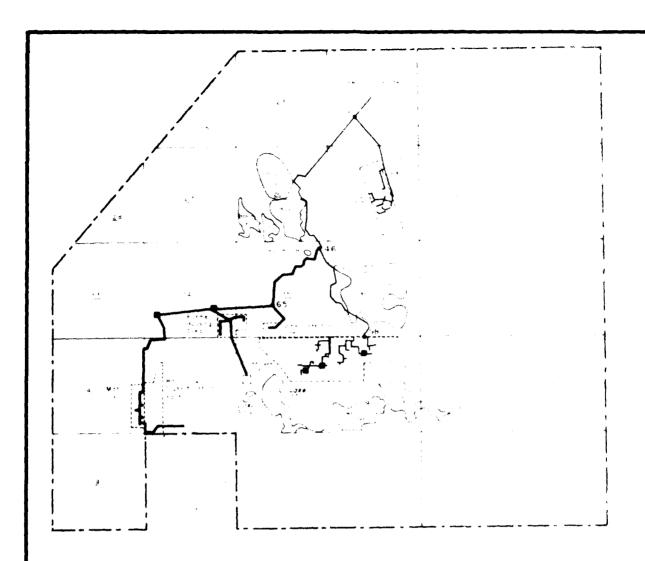
1.0 PHYSICAL SETTING

1.1 LOCATION AND DESCRIPTION

The sanitary sewer system for the railyard and administration areas is located in the southwestern part of the Rocky Mountain Arsenal (RMA) in Sections 2, 3, 4, 34, and 35. The railyard includes two areas known as the motor pool and the rail classification yard. The administration area includes three areas known as the officers' club, the former housing area, and the administration area. The buildings in the administration area were used for administrative purposes and were not associated with chemical activities. In the railyard area, the entomology and plant laboratory was previously shared by Shell and the Army. A map showing the location of these areas and the connecting sewer lines is presented in Figure SS-RA-1. The buildings that are connected to this system are listed in Table SS-RA-1 and are shown in Figures SS-RA-2a and SS-RA-2b. A detailed layout showing the location of field work activities is included as Plate SS-RA-1.

The railyard and administration areas sanitary sewer system includes approximately 37,700 feet (ft) of pipe. The specifications of the pipe used, as shown on the Rocky Mountain Arsenal basic information maps (COE, 1984), are presented below:

Diameter (inches)	<u>Material</u>	Type	Length (ft)
12	Vitrified Clay	Gravity	4,900
8	Vitrified Clay	Gravity	20,500
6	Vitrified Clay	Gravity	3,100
4	Vitrified Clay	Gravity	2,500
8	Steel	Fressure	3,600
6	Steel	Pressure	3,100



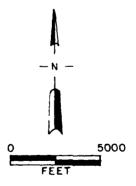
Legend

31 Section Number

Sanitary Sewer System

- Lift Station
- •46 Manhole with Number

Study Area for Railyard and Administration Area Portion of Sanitary Sewer System



Prepared for:

Program Manager's Office for Rocky Mountain Arsenal Cleanup Aberdeen Proving Ground, Maryland FIGURE SS-RA-I Location Map for the Sanitary Sewer System

Rocky Mountain Arsenal, Task 10

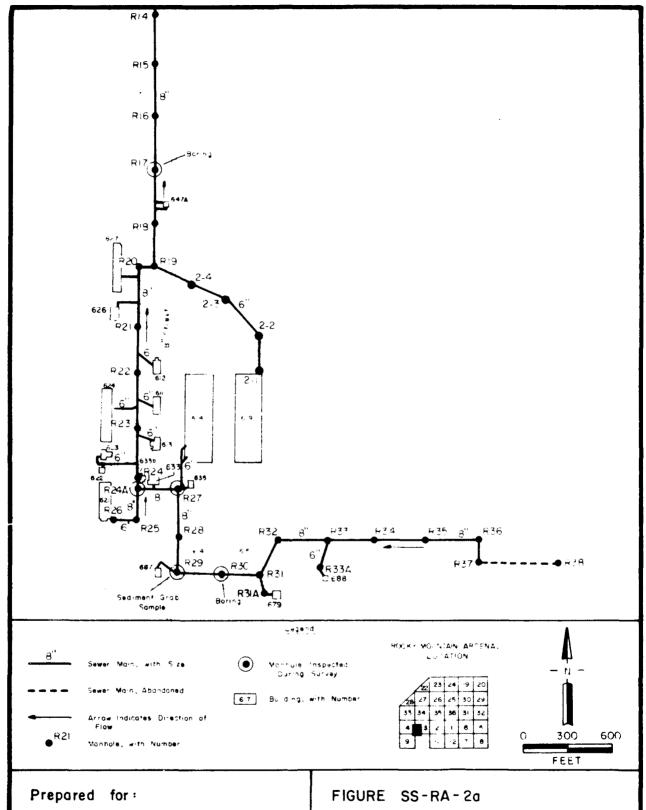
Prepared by: Ebasco Services Incorporated

TABLE SS-RA-1 Railyard and Administration Area Buildings Connected to the Sanitary Sewer

Wilding No.	Section	Building Description and Use
111	35	Administration
112	3 5	Communication
131	35	Family Quarters
151	34	Barracks
152	34	Barracks
153	34	Barracks
154	34	Barracks
155	34	Barracks
156	34	Combined Mess Hall
157	34	Barracks
158	34	Barracks
159	34	Barracks
162	34	Barracks
163	34	Bowling Alley
164	34	Barracks
165	34	Supply Building
166	34	Vault Storage Building
167	34	Hobby Shop
168	34	Unknown
383	2	Officers' Club
392	34	Sewage Lift Station
393	34	Sewage Lift Station
611	4	Administration
612	4	Plans Office
613	4	Director of Logistics
618	3	Warehouse
619	3	Warehouse
621	4	Property Disposal Warehouse
622	4	Paint Shop
623	4	Carpenter Shop
624	4	Field Equipment Repair Service
626	4	Machine and Welding Shop
627	4	Motor Pool
633	4	Cafeteria
633B	4	Entomology and Plant Laboratory
635	3	Changehouse
647A	4	Dispatcher's Office
679	10	Warehouse, Can-Scouring Facility
687	4	Unknown
688	9	Guard Tower

From: COE, 1984; WR & SK, 1942a, 1942b, 1942c.

Site SS-RA 0063U/0145A Rev. 8/1/88



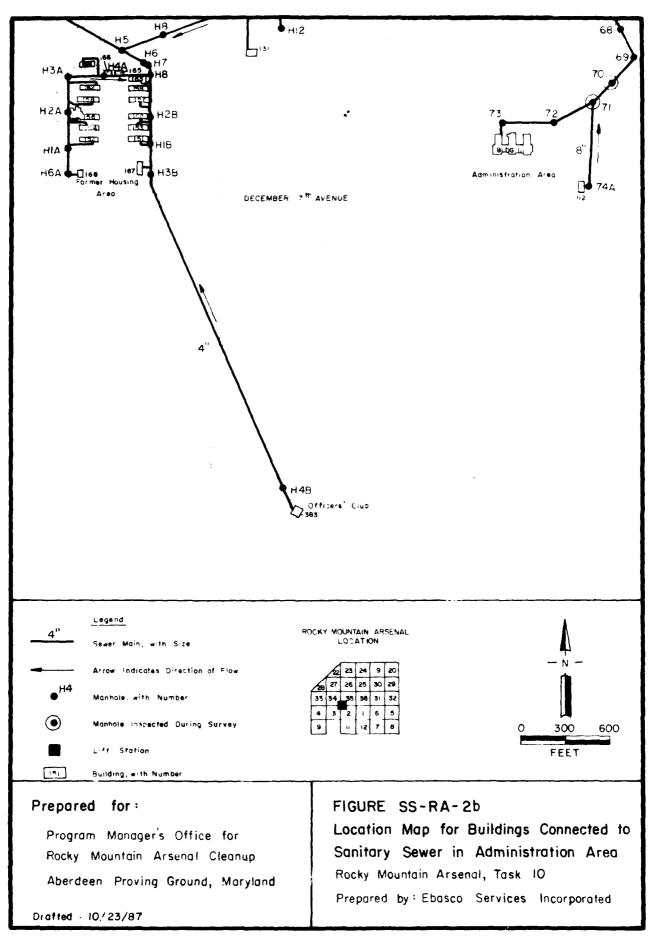
Program Manager's Office for Rocky Mountain Arsenal Cleanup Aberdeen Proving Ground, Maryland

Drafted : 10/23/87

Location Map for Buildings Connected to Sanitary Sewer in Railyard Area

Rocky Mountain Arsenal, Task 10

Prepared by: Ebasco Services Incorporated



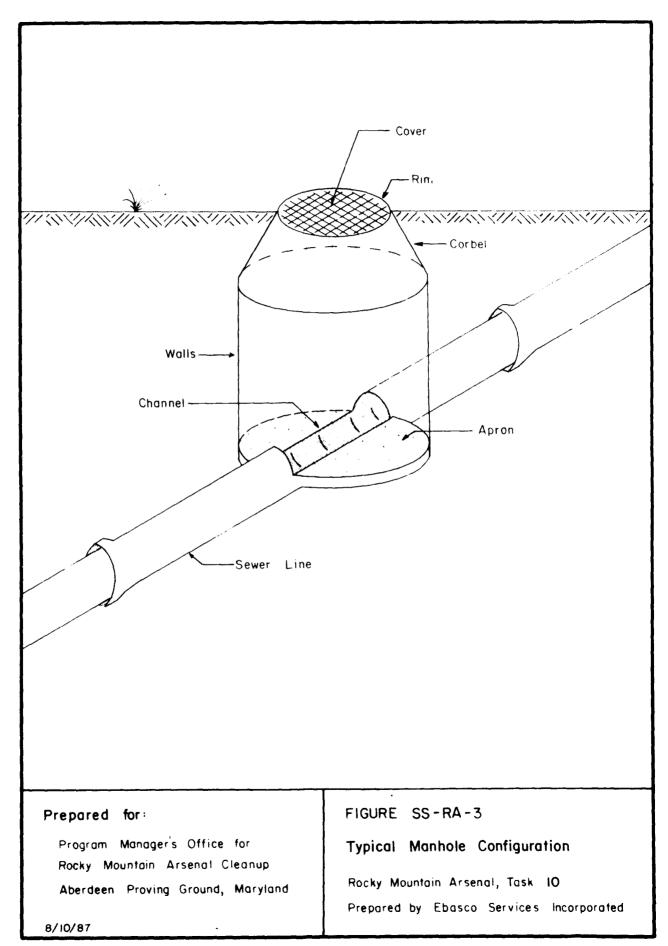
Manhole materials were assessed during field operations. A typical manhole cross-section showing the channel, walls, rim, cover, corbel, and apron is presented in Figure SS-RA-3. The manholes are constructed of brick and mortar, and the joints between the pipe lengths are sealed with oakum and cement.

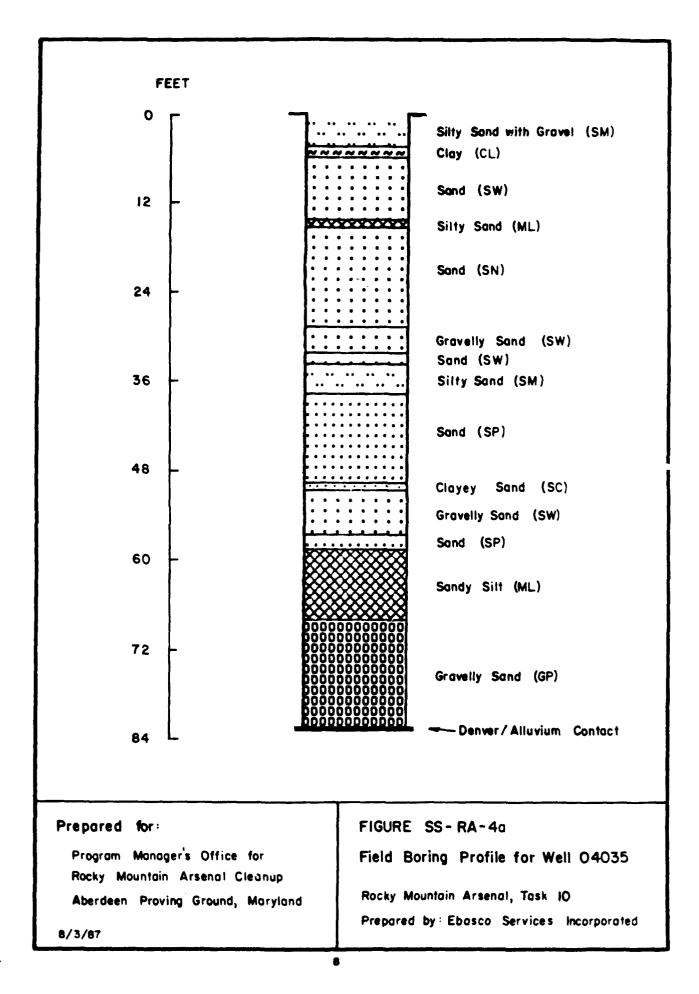
1.2 GEOLOGY

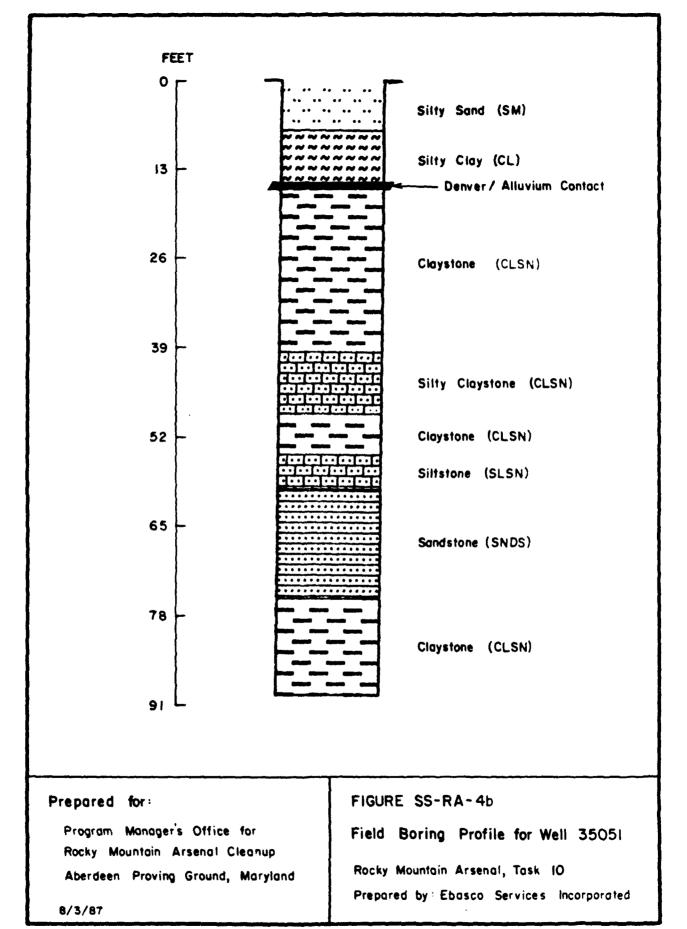
The two uppermost stratigraphic units beneath the railyard and administration area sanitary sewer system are Quaternary alluvium and the Denver Formation bedrock (May, 1982/RIC 82295R01). Wells drilled near the sanitary sewer line in the railyard area and in Section 34 along the western portion of the sewer system indicate an alluvial thickness ranging from about 71 ft (Well 03008) to 110 ft (Well 03001) (Plate SS-RA-3). The logs from wells in the area show an alluvial section primarily composed of sand and gravelly sand with lesser amounts of silt and clay as in Well 04035 (Figure SS-RA-4a), which is approximately 400 ft west of Manhole (MH) R20 (not shown). Borings drilled beneath MH R17 and MH R30 penetrated 5 ft of medium to coarse grained sand.

The eastern portion of the sewer system lies primarily in Section 35. Here the alluvium ranges in thickness from 0 ft near the center of the section, where the Denver Formation crops out, to 45 ft in Wells 35045 and 35019. Borelogs show that eoli n and alluvial materials in this area are composed primarily of silty sand with lesser clay, as shown in Well 35051 (Figure SS-RA-4b).

The underlying Denver Formation consists of claystone, shale, sandstone, and minor lignite. As wells and borings drilled in the vicinity of the railyard and administration area sanitary sewer system do not penetrate the Denver Formation completely, the total thickness of the formation beneath this area is unknown. A detailed description of the Denver Formation is found in a study by May (1982/RIC 82295R01).







•

1.3 HYDROLOGY

Surface water flow along the sewer line in the railyard and administration area is shown on Plate SS-RA-2. In the railyard area, surface water generally flows north along the west side of "B" Street. In Section 34, surface flow is primarily to the northwest. Several culverts cross under December 7th Avenue, carrying water from the northern portion of Section 3 into drainages that cross over the sewer line. One of the drainage channels is located west of the length of sewer line from MH R5A to MH R1. As the sewer crosses into Section 35, surface water flow is controlled by Sand Creek Lateral, which runs west and north of the sewer line throughout the section. No documented surface water quality studies were conducted for this area.

The primary groundwater flow direction across RMA is toward the northwest (Plate SS-RA-3). This flow direction is maintained throughout most of the railyard sanitary sewer system except in the vicinity of the motor pool and rail classification yard where the flow is predominantly toward the north (ESE, 1986b/RIC 86317RO1). In the spring of 1986, depth to groundwater in the vicinity of the sewer line ranged from 12.3 ft (5,241.3 ft above mean sea level, ms1) in Well 35052, located approximately 950 ft east of MH 71, to 62.5 ft (5,134.4 ft ms1) in Well 04033, located approximately 400 ft west of MH R20 (not shown). Groundwater was not reached in any borings along the sewer line.

In the area of the railyard, alluvial groundwater data are only available for Wells 03003, 03009, 03010, and 03523 and Well Cluster 04030, 04031, 04032, and 04033 (ESE, 1986b/RIC 86317R01). These wells are located within 800 ft of the sewer line and were sampled in late 1985 and early 1986. Potential contaminants identified in the wells in Section 3 include aldrin, dibromochloropropane, endrin, benzene, chloroform, and toluene. Samples from the well cluster, located 500 ft west of Manhole R18 (not shown) contained dibromochloropropane, benzene, chloroform, trans-1,2-dichloroethylene, trichloroethylene, and 1,2-dichloroethane. Downgradient Wells 04019 and 04020 were also sampled, but no target analytes were detected. Additionally, Wells 04035 and 04036 located approximately 500 ft west of the sewer line in the motor pool area (not shown) have recently been sampled under Task 38, and have

shown the presence of chloroform, trichloroethylene, 1,1,2-trichloroethane, 1,1,1-trichloroethane, benzene, and 1,1-dichloroethylene. In the administration area, upgradient alluvial Well 35052 contained isodrin and downgradient alluvial Well 35058 contained the dieldrin and chloroform. In samples from alluvial Well 34002, located between the former housing area and MN R1, no target analytes were detected. No alluvial wells downgradient of the system in Section 34 were sampled (ESE 1986b/RIC 86317R01).

Downgradient alluvial groundwater data are available for Section 35 (ESE, 1986b/RIC 86317R01). Wells 35012 and 35016 are located in the Basin A neck. Well 35012 contained chlorobenzene, dieldrin, isodrin, diisopropylmethyl phosphonate, 1,4-oxathiane, p-chlorophenylmethyl sulfide, p-chlorophenylmethyl sulfone, trichloroethylene, and benzene. Well 35016 contained diisopropylmethyl phosphonate, 1,4-oxathiane, dithiane, benzene, trichloroethylene, and chlorobenzene. Downgradient Wells 35034 and 35058 contained dieldrin and chloroform; Well 35034 also contained diisopropylmethyl phosphonate.

Because of the potential for additional contaminant sources in the vicinity of the sanitary sewer in this area, the presence of these chemicals in the wells downgradient from the sewer system does not imply that the sewer system is contributing to contamination in the groundwater.

2.0 HISTORY

Information on the history of the area defined as the railyard and administration area sanitary sewer was gathered through a search of the available literature. It has been prepared following full review of information identified during the course of discovery in <u>United States v. Shell Oil Co.</u>, Civil Action No. 83-C-2379 (consolidated with No. 83-C-2386) (D. Colo.). No review of aerial photographs was conducted for the largely underground system.

The sanitary sewer system was installed in the railyard and administration areas during the construction of RMA in the 1940s. Because construction of the

sewer system was not complete before RMA began operations, the railyard and temporary administration areas (former housing area) were serviced with septic tanks and drainage fields prior to connection with the sewer system. A 1945 history of RMA (CWS, 1945) indicates that both of these areas were connected to the sanitary sewer system by that time.

Two lift stations are located between the railyard collection system and the tie-in with the interceptor sewer line leading to the domestic wastewater treatment facility in Section 24 (Site 24-6). Approximately 6,800 ft of steel pipe carries wastewater under pressure between these lift stations and then on to a 12 inch gravity line north of the permanent administration building, Building 111. Much of the steel pipe used for this line had been used previously, and some was pitted by corrosion (CWS, 1945). No documentation was located to indicate that the pipe was repaired prior to installation. Overflow from the lift station north of the railyard (Building 393) ran into a shallow depression northwest of the station and just east of "B" Street (CWS, 1945).

The second lift station (Building 392) overflowed to the septic tank and drainage field used previously by the temporary administration area prior to connection with the sewer system (CWS, 1945). Visual observations indicate that the overflow was disconnected from the septic tank and drainage field and now discharges to a ditch and depression northwest of the lift station.

3.0 FIELD INVESTIGATION

3.1 PREVIOUS INVESTIGATIONS

The regional soil type in the vicinity of the railyard and administration area sewer line is of the Ascalon-Vona-Truckton Association. This association consists of loamy and sandy soils formed in wind-laid deposits on uplands that are somewhat excessively drained to well drained (USDA, 1974/RIC 81266R54).

The condition of the RMA sanitary sewer system was investigated in 1979 and 1980 (Black & Veatch, 1979/RIC 81266R35, 1980). These studies included verification of maps, estimates of infiltration and inflow, smoke testing, visual inspections, and water quality sampling.

12

Smoke testing indicated a blockage between MH 71 and MH 74A. The blockage may have been caused by a dip in the line (acting as a water trap), a partially caved-in pipe, or foreign material in the line. Open pit excavation and visual inspection of the sewer line between MH 60 and MH 61 showed that the line was in poor condition. The pipe showed signs of exfiltration and was on the verge of collapse. The study concluded that rainwater could have infiltrated the line easily along this section.

Additional infiltration points were located during smoke tests when smoke was seen rising from eleven prairie dog holes. These infiltration points were in the vicinity of MH 47, MH 58, MH 59, MH 60, and MH 62 and indicated the presence of cracked or broken pipe or offset and separated joints. Again, it was concluded that rainwater infiltration could have occurred at any of these points.

The general condition of the entire RMA sanitary sewer system was determined to be poor, and slip-lining of the entire system was recommended (Black & Veatch, 1979/RIC 81266R35). An alternate plan was to abandon the existing system (except in the South Plants area where slip-lining was again recommended) and install separate package treatment plants for the administration area, North Plants complex, and South Plants area. The latter alternative was chosen, but was never implemented due to declining activity at RMA.

Further studies conducted by the Army also indicated that the sanitary sewers were in poor condition (USAEHA, 1985). When V-notch weirs were used to measure the flow through MH R2 and MH R16 in the railyard area, it was found that as much as half of the flow was being lost through exfiltration. As part of the Army study, the flows were totaled daily for a period of six days. The total volume of flow through MH R16 for all six days was 74,200 gallons (gal.) and the total flow through MH R2 (downstream of R16) was 38,000 gal. Unfortunately, the flows during the study period were too low to give the required 2 inch head above the notch to minimize weir effects, so the usual accuracy of the weir was not attained.

Soil and water contamination associated with the sanitary sewer system has received some attention in previous studies. The previous study by Black and Veatc' (1979/RIC 81266R35) included water sampling, but only two manholes in the administration area and none in the railyard were checked. Two water samples were taken on different days between August 30 and September 14, 1979, from MH 49 and MH 55. Both of these manholes are close to the point where the interceptor line from the South Plants area joins the line from the railyard and administration areas.

Detection limits were not stated for this study, but the chemical analyses were performed by the RMA laboratory. At that time the detection limits for the laboratory in parts per billion (ppb) were as follows (Jones, 1987):

Analyte	Concentration (ppb)
Dibromochloropropane	0.2
Aldrin	1.0
Isodrin	0.5
Dieldrin	0.5
Endrin	0.5
Diisopropylmethyl phosphonate	2.0

Further investigation has revealed that the values presented in the Black and Veatch report that are equal to the detection limits should have been noted as "less than" the detection limit (Jones, 1987). When this is taken into consideration, the data show that dibromochloropropane and isodrin were the only analytes found at levels above the detection limits. Analysis showed isodrin present in one of the samples from MH 55 at 0.56 ppb and dibromochloropropane present in one of the samples from both MH 49 and MH 55 at 0.34 and 0.26 ppb, respectively.

In 1980, evidence was found of a dibromochloropropane groundwater plume originating in the railyard area and moving to the northwest. Although data from Shell Oil Company indicate the plume originates in the railyards area

east of the sewer line in Section 3, an exact source has not been determined (Swift & Chiang, 1987). Further investigations are being carried out by Ebasco under Tasks 7 and 20 (Ebasco, 1987c). The Irondale Groundwater Treatment System was installed along the northwestern boundary of RMA when the dibromochloropropane plume was discovered (USAEWES, 1984/RIC 85130R01). It should be noted, however, that the water table in this area is 60 ft below the ground surface, and therefore does not come into contact with the sewer system. It is not possible for dibromochloropropane from the groundwater plume to infiltrate the sewers and be transported downstream within the system.

During the sewer system studies performed by the Army (USAEHA, 1985), water samples were collected and analyzed at MH R2 and MH R16 in the railyard and administration areas. Chloroform was found in both manholes at concentrations of 16 and 37 micrograms per liter, ug/L, respectively. These values represent average concentrations over a six day study period.

Additional studies were initiated by the U.S. Environmental Protection Agency (EPA) when trichloroethylene was found in wells to the west of RMA. At the request of the EPA, the Army is sponsoring continuing studies to evaluate RMA's possible contribution to the trichloroethylene contamination existing off-post (Ebasco, 1987a). These studies cover the western tier of RMA as well as the rail classification yard area and the abandoned officers' housing area.

3.2 FIELD SURVEY

3.2.1 Field Program

Using the methodology presented in the Task 10 Technical Plan (Ebasco, 1987b/RIC 87336R30) manholes were inspected and sampled in the railyard and administration areas. Field observations led to the inspection of 20 manholes rather than the 15 recommended in the Technical Plan. Soil samples were collected from beneath 3 manholes, sediment samples were collected from inside 5 manholes, and soil samples were collected in the overflow ditches from the lift stations (Buildings 392 and 393). Hydrostatic testing of the pressure line from Building 393 to Manhole 65 was not done at the request of the facilities engineer. No geophysical borehole clearance for safety purposes

was conducted as there was no likelihood of unexploded ordnance, buried metal, or other buried objects.

The manholes that were inspected were generally in good condition. Table SS-RA-2 summarizes observations of the manholes obtained by visual inspection and probes conducted with a metal rod. The manholes were all constructed of brick and mortar, with concrete aprons and concrete or vitrified clay pipe (VCP) invert channels. The corbels were solid, with areas of eroded mortar near the top of some manholes. Standing water and sediment were found in several of the manholes in the channel or on the apron.

Based on the results of the manhole reconnaissance survey, sediment grab samples were collected from 5 manholes. The manholes were selected based on their location in the system. These manholes are located throughout the railyard and administration areas and were sampled to provide an indication of the source of potential contamination in the sewer system.

The three manholes selected for drilling (R30, R17, and 64) were determined to be "worst-case" manholes. All have VCP invert channels with joints in the manhole. Channels constructed in this manner have a greater potential for leaking than concrete channels. MH R30 has joints at each end of the manhole. MH 64 has a VCP channel, and wet areas and gaps were observed at the connection to the inlet and outlet pipes.

During drilling of the manholes it was found that the VCP channels in MH R30 and MH R17 were installed directly on top of the underlying soil. The first sample from each of these manholes had several inches of reddish brown silty sand directly under the VCP channels. By comparison, the bottom of MH 64 was constructed of brick covered with a layer of mortar. The VCP channel was set into this mortar layer. The material in the first sample under MH 64 was very moist.

In addition to the manhole borings and grab samples, a boring was hand-augered at each of the two lift station overflows. Overflows of the lift stations are

Table SS-RA-2. Manhole Reconnaissance Survey Observations. Pape 1 of 2.

oblems concrete concrete tight oblems concrete concrete tight mortar not evident oblems concrete concrete tight hape oblems concrete concrete tight hape oblems concrete concrete tight noted joint no problems joint no problems solid tight solid concrete concrete no mortare rax ng mortar concrete concrete mortared riar ng mortar concrete concrete mortared riar oblems concrete concrete mortared riar oblems concrete concrete mortared riar riar oblems concrete concrete mortared riar riar riar oblems concrete concrete mortared riar ri	Manho le	Depth	Materia?	E	Walls	Apron	Channe l	Connections	Comments
6.8 ft brick broken noted noted concrete concrete evident broken noted noted brick crumbling top layers in concrete concrete tight brick no problems noted brick no problems concrete alab noted	RSA	6.4 ft	brick	Broken. Gaps between bricks and rim.	no problems noted	concrete	concrete	tight	Dirt and bricks mounded around manhole on ground.
7.5 ft brick concrete, no problems concrete concrete tight 7.1 ft brick crumbling top layers in concrete concrete tight 7.5 ft brick no problems no problems concrete concrete tight 8.5 ft brick no problems no problems concrete concrete tight 7.9 ft brick no problems no problems concrete concrete no mortal noted noted noted concrete slab noted concrete slab noted concrete slab noted no problems to passes a sounds hollow feels cracked tight concrete slab noted in mortal noted no problems to passes a sounds hollow feels cracked tight concrete slab noted in mortal noted no problems to passes a sounds hollow feels cracked tight concrete slab noted in mortal noted in mortal noted no problems to passes a sounds hollow feels cracked tight concrete slab noted in mortal no problems to passes a search and no problems at each and no problems displaced near top no problems concrete concrete no problems displaced near top no problems concrete no problems no problems concrete no problems no problems concrete no problems no problems no problems concrete no problems no p	Æ Æ	6.8 ft	brick	South side broken	no problems noted	concrete	concrete	mortar not evident	Some cracked mortar near top of walls.
7.5 ft brick no problems noted	R7	7.5 ft	brick	concrete, broken	no problems noted	concrete	concrete	tight	No mortar visible in connections.
8.5 ft brick no problems no problems concrete very deep no problems 8.5 ft brick no problems no problems concrete VCP with a no problems noted no problems in thick no problems no problems in thick no problems concrete concrete no problems noted 1.9 ft brick brick no problems 4-inch thick concrete slab noted concrete action tight tight 8.6 ft brick d-inch thick concrete slab noted concrete action tight tight 8.1 ft brick no problems top has gaps concrete concrete mortate 8.5 ft brick brick no problems top has gaps concrete concrete mortate 8.5 ft brick brick no problems top has gaps concrete concrete mortate 8.5 ft brick brick no problems no problems concrete mortate 8.8 ft brick brick no problems top has gaps concrete concrete mortate	R12	7.1 ft	brick	crumbling	top layers in bad shape	concrete	concrete	tight	One inch of moist sediments on apron.
8.5 ft brick no problems noted noted noted noted noted joint noted joint noted	R13	7.5 ft	brick	no problems noted	no problems noted	concrete	very deep	no problems noted	Loose mortar around top of wall. Sediments around outer 5 inches of apron.
7.9 ft brick no problems no problems concrete concrete no mortar noted noted noted noted noted concrete slab solid concrete mortared noted not	R17	8.5 ft	brick	no problems noted	no problems noted	concrete	VCP with a joint	no problems noted	
7.9 ft brick no problems concrete concrete no mortar noted noted noted noted noted noted concrete slab noted concrete slab noted concrete slab noted concrete slab concrete slab concrete slab noted no problems top has gaps concrete mortared noted	R19								Not located - buried in parking lot.
not measured brick 6-inch thick no problems sounds hollow feels cracked tight concrete slab noted not more teas and in mortare concrete mortared noted in mortare concrete VCP, joints no problems displaced near top to the brick some cracks no problems concrete concrete no problems noted n	R20	7.9 ft	brick	no problems noted	no problema noted	concrete	concrete	no mortar	Pieces of concrete on apron.
not measured brick 4-inch thick feels solid concrete solid tight concrete slab concrete mortared noted in mortar concrete concrete mortared s.5 ft brick broken and missing mortar concrete VCP, joints no problems displaced near top at each ond noted noted noted noted noted noted to brick some cracks no problems concrete concrete no grout	R24A	8.6 ft	brick	8-inch thick concrete alab	no problema noted	sounds hollow	feels cracked	tight	
8.1 ft brick no problems top has gaps concrete mortared noted in mortar forcerete concrete mortared some cracks no problems concrete vCP, joints no problems displaced near top at each and noted horick some cracks no problems concrete concrete no grout	R27	not measured	brick		feels solid	concrete	solid	tight	Standing water in east side of channel. Sediment on apron.
5.5 ft brick broken and missing mortar concrete VCP, joints no problems displaced near top at each and noted noted 6.8 ft brick some cracks no problems concrete concrete no grout	. R29	3. 1 ft	brick	no problems noted	top has gaps in mortar	ر ملاز لاه لا ه	concrete	mortared	Sediment in channel, some on apron. MH in drainage, covered with dirt and cobbles.
4.8 ft brick some cracks no problems concrete concrete no grout	R30	5.5 ft	brick	broken and displaced	missing mortar near top	concrete	VCP, jointa at each end	no problems noted	One inch of sediment in channel.
	1	4.8 ft	brick	some cracks	no problems	concrete	concrete	no grout	Areas of standing water in channel.

Table SS-RA-2. Manhole Reconnaissance Survey Observations. Page 2 of 2.

Manhole	e Depth	Material	, E	Walls	Apron	Channel	Connections	Comments
H-2	.2 not measured brick	brick	no problems noted	no problems noted	solid	solid	no problems noted	Full of standing water. Sediment fills channel.
94	7.2 ft	brick	no problems noted	bricks are chipped	concrete	deep	top of inlet is cracked	Sediment in inlet from southwest. Piece missing from inlet.
\$0	0 4.5 ft	brick	concrete is broken	nome cracked bricks and missing mortar	concrete	concrete	surrounding bricks chipped	Standing water, dead animal and sludge in channel.
49	3.9 ft	brick	no problems noted	no problems noted	brick and mortar eroding on east side	mortar	wet areas in connections, gap	
\$	5 5.5 ft	brick	broken concrete	very crumbly	bilos	solid solid	no problema noted	Channel filled with black sludge. Apron covered with pieces of brick and mortar. Inlet comes from lift station.
£ 18	4.0 fe	brick	no problems noted	no problems noted; wet 1 ft above apron	concrete	concrete	no problems noted	Wet mud on apron. No observed cracks.
11	1 5.5 ft	brick	no problems noted	no problems noted	anlid	solid	no problems noted	

not common, but could occur in the event of equipment failure. The overflow at the western lift station, Building 393, appeared to enter a ditch about 6 ft wide. Boring LS0001 was drilled at the source of this ditch, approximately 50 ft west of the lift station. The ditch was followed for some 200 ft before it was lost. The ditch was dry and there was no catch basin evident at the end of it. The eastern lift station, Building 392, overflowed to a ditch approximately 3 ft wide and 275 ft long. Boring LS0002 was drilled at the source of this ditch, approximately 2 ft northwest of the lift station. This ditch terminated in a basin about 20 ft wide and 80 ft long. The top 3 ft of soil was black and was saturated at the time of sampling.

The railyard and administrative areas sanitary sewer was investigated under Task 10 in the winter and spring of 1987. A total of 5 borings, drilled to a maximum depth of 13.5 ft, and 5 sediment grab samples, yielding a total of 15 samples, were completed and are summarized below. Borings R17, R30, and 64 were drilled through their corresponding manholes, and Borings LS0001 and LS0002 refer to the two lift stations, 393 and 392, respectively.

Manhole No.	Type	Depth From Ground Surface (ft)	Depth Beneath Sewer Invert (ft)	No. of Complex
mannote no.	TABE	Glound Surrace (10)	Sewer mivere (1c)	No. of Samples
H 2	Grab	5.2	0	1
R12	Grab	7.2	0	1
R17	Boring	13.5	5.0	2
R29	Grab	7.9	0	1
R30	Boring	10.5	5.0	2
50	Grab	4.7	0	1
64	Boring	9.1	5.2	2
65	Grab	5.4	0	1
Lift Station				
LS0001	Boring	5.0	~	2
LS0002	Boring	5.0	-	2

It should be noted that depths were measured from the ground surface, not from the bottom of the manhole. In the manhole borings, the first sample was taken from directly under the manhole channel, and the second was taken 4 to 5 ft

19

Site SS-RA 0063U/0145A Rev. 8/1/88

1

below the first. The depths shown for the sediment samples represent the depth of the manhole channel. Borings at the lift stations were made from the ground surface and did not involve manholes.

All samples from the manhole borings were analyzed by gas chromatography/mass spectrometry (GC/MS) for volatile and semivolatile organics; by an inductively coupled argon plasma (ICP) screen for metals; and by separate analyses for arsenic, mercury, and thiodiglycol. Borings at the lift stations were also analyzed by GC/MS for volatile organics (except the 0-1 ft interval) and semivolatile organics; by an ICP screen for metals; and by separate analyses for arsenic, mercury, thiodiglycol, and agent degradation products (organo-acids). The sediment grab samples were analyzed by GC/MS for semivolatile organics; by an ICP screen for metals; and by separate analyses for dibromochloropropane, arsenic, mercury, and thiodiglycol. Samples from the 0 to 1 ft intervals of the lift station borings and the sediment grab samples were not analyzed for volatile organics because they were in direct contact with the atmosphere. Any volatile organic compounds would have volatilized before the samples were collected. Appendix SS-RA-A presents the specific target analytes for which laboratory analyses were conducted. A summary of the results of these analyses is presented in Table SS-RA-3, Section 3.2.4 of this report.

The remedial investigation program for the sanitary sewer in the railyard and administration areas was developed and implemented based on historical documentation and other information available at the time of its implementation. Since that time, previously unavailable information has been identified and incorporated into the history section of this report. Furthermore, this additional information has been evaluated in detail to determine how it might impact the investigation approach for this system. Based upon this evaluation, it has been determined that the additional information collected since the field program was designed does not substantially alter the view of potential contamination for this system. As a result, the field program as conducted is judged to provide a complete and accurate investigation of the possible contamination associated with the sanitary sewer in the railyard and administration areas.

3.2.2 Field Observations

To ensure safety, in situ air monitoring was conducted during the sampling operations using a photoionization detector (HNU) and an organic vapor analyzer (OVA). Readings from the HNU were above background for the two samples taken from Boring LS0002; however, readings in the breathing zone were at background levels. All other OVA and HNU readings were at or near background levels.

Neither an M8 alarm nor an M18A2 test kit was used, as there was no likelihood of the presence of chemical agents at this site. No unexploded ordnance, buried metal, or other objects were detected during sampling operations. No unusual coloring or staining of the core samples was noted.

3.2.3 Geophysical Exploration

A geophysical survey was not conducted as part of the railyard and administration areas sanitary sewer study, as no underground metallic utilities were expected to be present at the sampling sites.

3.2.4 Analyte Levels and Distribution

Methylene chloride, dibromochloropropane, cadmium, chromium, copper, lead, zinc, arsenic, mercury, and chloroacetic acid were found at concentrations within or above their indicator levels in samples from the sanitary sewer system in the railyard and administration areas. The number of samples containing each analyte, and the concentration range, median, mean, standard deviation, detection limit, and indicator level are listed in Table SS-RA-3. The results of geologic field observations, air monitoring during drilling, and the chemical analysis of each soil sample are summarized in Table SS-RA-4.

Indicator levels and ranges were established to assess the significance of metal and organic analytical values. The indicator levels are the method detection limits for organic compounds. The indicator ranges for metals reflect the concentrations expected to occur naturally in RMA alluvial soils. Selection of these ranges is discussed in the Introduction to the Contamination Assessment Reports (ESE, 1986a RIC 87336R01).

rable SS-RA-3. Summary of Analytical Results for the Railyard and Administration Area Sanitary Sever System. Page 1 of 1.

					Concentra	Concentration (ug/g)		
		1				DataChem	CAL	204-014
	•				Standard	Detection	Detection Limit	Level
Constituent	Number of Samples*	Range	Median**	Mean**	Deviation**	Limit		
Detected								
Volatiles (N-8)				1	,	2	7.0	DĽ
methylene Chloride		-	,	,				
Semivolatiles (N=15)								
None detected			,	,	1	0.0050	0.014	ŊŢ
Dibromochloropropane (N=5)	7	0.0072-0.014	۱ -	1				
ICP Metals (Nº15)					1	0.74	9.66	1.0-2.0
	1	1.8	, 7	23	22	5.9	7°5	20-35
En Lacut	:	10-81	0.4	88	140	•	13	25-40
Copper	Ξ.	22-700	1	130	220	. 00 00	5.6	08-09
Lead	15	22-180	8	<u>.</u>	16	7.5	5.0	DL-10
	•	3.7-8.4	•	1	1	7	0 060	DL-0.10
Argenic (Nels)	vo	0.25-1.3	1.1	0.86	0.42	0.050		
Mercury (Nels)								
Thiodiglycol						4.2	::	1 0
Thiodiglycol (N=15) Chloroacetic acid (N=9)	0 E	62-65	•	t	1	ę.		

None detected

Agent Products (N=2)

DL - The indicator level is the detection limit for DataChem and CAL Laboratories, as appropriate

N - Number of samples analyzed

- Number of samples in which constituent was detected; only these sample results were used in statistical analyses

- Number of samples in which constituent was detected; only these sample results were used in samples

- Hedian, mean, and standard deviation not calculated when constituent detected in fewer than 5 samples

- Hedian, mean, and standard deviation method

- Hedian, mean, and standard for analytical method

Table SS-RA-4. Results of Pield Study. Page 1 of 2.

	Sample H2*	Sample R12*	Boring R17	R17	Sample R29*	Borin	Boring R10
Depth (feet) Geologic Material	5.2 NR	7.2 NR	8.5~9.5 Sand	12.5-13.5 Gravelly Sand	7.9 MR	5.5-6.5 Sand, Trace Pebbles	9.5-10.5 Sand, Trace Pebbles
Percent PinesVO			0	0		0	0
AIR MONITORING							
Volatile Organic Readings (ppm) HNUS OVAS	BKD 0-2.4	BKD 0-2.4	OK N. D. S. D. S.	BKD NR	RN RN	NR 1-1.6	R K
SOIL CHEMISTRY							
Volatiles (ug/g) Nethylene chloride	٧N	٧	BDL	708	NA NA	BDL	1
Semivolatiles (ug/g) None detected							
Dibromochloropropane (ug/g)	BDL	300	X.	¥¥	BDL	XX	4 %
ICP Metals (ug/g)						-	
Cadmium	BDL	BDL	807	BDL	J.8	BDL	BDL BDL
Chrosics	20	22	BDL BDI	BDL	500	8.5	BDL
Copper	700	6 6	25	TOB	170	22	BDL
2012	120	87	25	22	170	4 3	24
Arsenic (ug/g)	BDL	BDL	108	BDL	₩.	BDL	BDL
Mercury (ug/g)	BDL	0.25	BDL	HDL	86.0	BDL	BPL
Thiodiglycol (ug/g) Thiodiglycol Chloroacetic acid	8DL 63	ROL BDL	BDL.*• NA	RDL.*• NA	BDI. 65	BDL++	BDL
Agent Products (ug/g)	<u> </u>	« z	4 7	W.	¥	4 2	¥ X

BDL - Below detection limit
BKD - Background
NA - Background
NA - Not analyzed
NA - Not analyzed
NR - Not recorded
S - As referenced to calibration standard of methane for OVA, and honzene for HNU; reading has been adjusted to account for background level
S - As referenced to calibration standard of methane for OVA, and honzene
VO - As determined by visual observation and rounded to the nearest 5 percent

• - Sediment grab sample
• - Sediment grab sample

• - Sample was sent to the FSE lab, which analyzed for thiodiglycol with a detection limit of 2.6 ug/q and did not analyze for chloroacetic acid

Site SS-RA 4900A/1041A Rev. 7/29/88

5
ot
2
Page
Study.
Field
of
Results
SS-RA-4.
5 e

1 1

Table SS-RA-4. Results of Field Study.	Study. Page 2	of 2.						
	Sample 50*	Boring 64	94	Sample 65*	Boring LS0001	20001	Boring	Boring LS0002
Depth (feet) Geologic Material	4.7 NR	4.1-5.1 Clayey Sand Trace Cobbles	8.1-9.1 Sandy Clay	5.4 NR	0-1 Sandy Clayey Silt	4-5 Silty Sand	0-1 Silty Sand w/Organics	4-5 Clayey Silty Sand
Percent PinesVO		30	09		65	25	0+	40
AIR MONITORING								
Volatile Organic Readings (ppm)								;
HNUS OVAS	BKD NR	BKD BKD	N N N	BKD	NR BKD	NR BR D	80 BKD	90 00 00 00 00 00 00 00 00 00 00 00 00 0
SOIL CHEMISTRY								
Volatiles (ug/g) Methylene chloride	V X	BDL	BDL	ž	¥ X	BDL	ď.	BDL
Semivolatiles (ug/g) None detected								
Dibromochloropropane (ug/q)	0.014	NA NA	Y.	0.0072	NA	NA	¥X	¥2
ICP Metals (ug/g)	BDL	BDL	BDL	90[BOL	BDL	80t.	80L
STATE OF THE STATE	BDL	10	13	10	7 4	13	51	: =
Copper	180	BDL	13	63	2 C	BDC	£ 4.	BDL
read.	29 180	BDL 26	80L	0*	87	84	88	65
		E C	3.7	3.7	BDL	BDL	BDL	BDL
Arsenic (ug/g)	1.1	BDL	, 108	1.3	0.42	BDL	1.1	BOL
Thiodiglycol (ug/g) Thiodiglycol	BDL	#₽,708	RDL**	Bol	BDL	BDL	BDL BDL	B DL
Chloroacetic acid	BDL	K K	« z	2.9	779			ě
Agent Products (ug/g)	KN.	Z A	4 2	K Z	V	4 Z	apr	706

BDD - Beckground

NA - Not analyzed

NA - Not recorded

S - As referenced to calibration standard of methane for OVA, and benzene for HNU; reading has been adjusted to account for background level

S - As referenced to calibration standard of methane for OVA, and benzene for HNU; reading has been adjusted to account for background level

S - As referenced to calibration standard of methane for OVA, and benzene for HNU; reading has been adjusted to the nearest 5 percent

• - Sediment grab sample

• - Sample was sent to the ESE lab, which analyzed for thiodigiyens with a detection limit of 2.6 uq/q and did not analyze for chloroacetic acid

Site SS-RA 4900A/1041A Rev. 7/29/88

The distribution of the analytes detected within or above their indicator levels in the sampling program is presented in Plate SS-RA-4. A tabulation of all analytical data associated with the sampling program is presented in Appendix SS-RA-B.

The sampling program for this part of the sanitary sewer included both sediment grab samples and samples from borings. Results from each type of sampling method will be discussed separately, although all results are combined in Table SS-RA-3.

Borings: Borings were drilled through the bottoms of three manholes and at the overflows of the two lift stations. Methylene chloride was found in the 9.5 to 10.5 ft interval of Boring R30 at a concentration of 1 microgram per gram (ug/g), slightly above its detection limit of 0.7 ug/g. Lead was found at 25 ug/g, the lower limit of its indicator range, in the 8.5 to 9.5 ft interval of Boring R17. Boring 64 contained arsenic within its indicator range at 3.7 ug/g in the 8.1 to 9.1 ft interval. Borings at the lift station overflows contained several metals within or above their indicator ranges in the surface samples. The 0 to 1 ft interval of Boring LS0001 (lift station 393) contained copper at 48 ug/g, lead at 38 ug/g, zinc at 87 ug/g, and mercury at 0.42 ug/g. Lead was within its indicator range and copper, zinc, and mercury were above their indicator ranges in this sample. The 0 to 1 ft interval from Boring LS0002 contained copper, lead, zinc, and mercury above their indicator ranges at 57 ug/g, 43 ug/g, 89 ug/g, and 1.1 ug/g, respectively. No target analytes were detected within or above their indicator levels in the 4 to 5 ft intervals of the lift station borings.

Sediment Samples: The sediment grab samples taken from inside manholes did not contain volatile or semivolatile organic compounds at levels detectable by the GC/MS screen. Although dibromochloropropane was not detected in the semivolatile analysis where its detection limit is 0.3 ug/g, it was detected at 0.014 ug/g in Grab Sample 50 and at 0.0072 ug/g in Grab Sample 65 in a separate analysis. This analytical method utilized gas chromatography/electron capture techniques, and has a detection limit of 0.005 ug/g.

All of the sediment grab samples contained elevated levels of metals. Cadmium was found within its indicator range at 1.8 ug/g in Grab Sample R29. Chromium was found at 50 ug/g in Grab Sample H2 and at 81 ug/g in Grab Sample R29, above its indicator range in both cases. Copper and lead were found above their indicator ranges in all of the grab samples except Grab Sample 50, where lead was present within its indicator range and Grab Sample R12, where copper was found within its indicator range. Grab Sample H2 contained 40 ug/g of copper, Grab Sample R12 contained 35 ug/g, Grab Sample R29 contained 500 ug/g, Grab Sample 50 contained 180 ug/g, and Grab Sample 65 contained 63 ug/g. Lead was found at 700 ug/g in Grab Sample H2, at 99 ug/g in Grab Sample R12, at 170 ug/g in Grab Sample R29, at 29 ug/g in Grab Sample 50, and at 87 ug/g in Grab Sample 65. Zinc was present at 120 ug/g in Grab Sample H2, at 87 ug/g in Grab Sample R12, at 170 ug/g in Grab Sample R29, and at 180 ug/g in Grab Sample 50. These concentrations are all above the indicator ranges of these metals. Arsenic was within its indicator range at levels of 8.4 ug/g and 3.7 ug/g in Grab Samples R29 and 65, respectively. Mercury was above its indicator range at 0.25 ug/g in Grab Sample R12, at 0.98 ug/g in Grab Sample R29, at 1.1 ug/g in Grab Sample 50, and at 1.3 ug/g in Grab Sample 65. Chloroacetic acid was present at 63 ug/g in Grab Sample H2, at 65 ug/g in Grab Sample R29, and at 62 ug/g in Grab Sample 65, all above its indicator level.

In addition, several compounds were detected by GC/MS that were not included in the target compound list and that were not conclusively identified. Table SS-RA-5 lists the boring number, sample interval depth, relative retention time (shown as "unknown number" on the table), concentration, sample number, lot, best-fit identification, and comments for these nontarget compounds. It should be noted that an individual compound may have more than one retention time, and also that a particular retention time may be assigned to more than one compound. Therefore, Table SS-RA-5 provides only a general indication of additional compounds that may be present. Nontarget compounds of note include several tentatively identified hydrocarbons ranging in size from 12 to more than 26 carbons. These were found at concentrations of 0.2 to 0.9 parts per million (ppm) and included linear, cyclic, and branched configurations. These were found in all samples except grab samples from MH R12 and MH R29 and Borings R17 and R30.

Table SS-RA-5. Tentative Identification of Nontarget Compounds. Page 1 of 2.

Borehole Number	Depth (ft)	Unknown Number	Concentration (ppm)*	Sample Number	Lot	Best-fit Identification	Comments
H2**	5.2	603	0.2	004	ВНХ	linear hydrocarbon, C-19	
		635	0.2	700	AHX	cyclic hydrocarbon, C-25	
		979	0.2	700	RHX	branched hydrocarbon, C-25	
		650	0.2	700	BHX	branched hydrocarbon, C-26	
R12**	7.2			003	BHX		×
712	8.5-9.5			007	BSR R		¥
				800	BSU		¥
	12.5-13.5			800	BSR		×
		615	0.7	600	asa	nonanedioic acid, dibutyl ester	Q
R294#	7.9	609	0.7	002	BHX	hexadecanoic acid	۵
		619	9.0	007	BHX	octadecanoic acid	Q
R30	5.5-6.5			600	RSR		×
				010	ASA		×
	9.5-10.5			002	RSV		¥
2044	4.7	584	9.0	900	RHX		<
		209	0.3	900	BHX	cyclic hydrocarbon, C-20	
		610	2	900	BHX	hexadecanoic acid	٥
		611	~	900	RHX		۰
		611		900	X HX	molecular sulfur, S8	، ء
		613	2	900	BHX	molecular sulfur, S8	c /
		614	, ,	900	X HX	molecular sulfur, S8	a
		919	۰.۰	900	X 10 8	cyclic nydrocaroon, c-z,	_
		631		900	жнх	ethanol, 2-butoxy, phosphate (3:1)	ı
44	4.1-5.1			003	BUG		×
ţ		805		000	200	bi De Jonatone	۵
		809		002	HIM		<
		609	~	003	HOM	hexadecanoic acid	۵
		618	6.0	002	BITH		۷
		619	9.0	002	BUH	octadecanoic acid	۵
		636	0.5	002	BUH	branched hydrocarbon, C-25	
	8.1-9.1			003	RUG		¥
		609	0.5	003	RUH	hexadecanoic acid	۵
		91.9	0.3	003	BIH	branched hydrocarbon, C-25	
		757	-	,,,,	HIM		<

A - No positive identification
D - Derived from natural products
K - None detected
+ - Values reported are blank corrected

Site SS-RA 4869A/1041A Rrv. 5/11/88

Table SS-RA-5. Tentative Identification of Nontarget Compounds. Page 2 of 2.

Municot Concentration Sample Internation Sample Internation Concentration Sample Internation International Internation		Best-fit Identification	Comments	ļ
5.4 609 1 0.5 005 005 005 005 005 005 005 005 005		Identification	Commente	ļ
5.4 609 1, 005 619 0.5 005 620 0.9 005 631 0.4 005 643 0.4 005 643 0.4 005 643 0.4 005 644 0.5 0.4 005 647 0.5 005 649 0.5 005 649 0.5 005 649 0.5 006 640 0.5 008 640 0.5 008 640 0.5 008 641 0.5 005	· ·			
619 0.5 005 620 6.9 005 638 0.4 005 643 0.4 005 643 0.4 005 643 0.4 005 643 0.4 005 641 0.5 006 642 0.5 008 645 0.9 008 645 0.9 008 645 0.9 008 645 0.1 008 645 0.2 005 640 0.5 005 640 0.5 005 640 0.5 005 641 0.5 005 641 0.5 005 642 0.1 007 641 0.2 005 644 0.4 006 645 0.6 006 646 0.6 008 647 0.6 006 648 0.6 006 648 0.6 006 649 0.6 006 649 0.6 006 640 0.6 006 640 0.6 006 640 0.6 006 640 0.6 006 640 0.6 006 641 0.6 006 641 0.6 006 642 0.6 006 644 0.6 006 645 0.6 006 646 0.6 006 647 0.6 006 648 0.6 006 648 0.6 006 649 0.6 006 649 0.6 006	_		c	
620 0.9 005 615 0.4 005 643 0.4 005 643 0.4 005 647 0.5 006 647 0.5 008 4-5 0.6 008 4-5 0.9 005 649 0.5 008 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 005 64-5 0.9 006 6	_	brenched hydrocarbon C-23	2	
6.15 0.4 005 6.18 0.6 005 64.3 0.4 005 64.3 0.4 005 64.1 0.5 0.05 0.5 0.08 4-5 6.19 0.5 0.08 6.19 0.5 0.08 6.19 0.5 0.08 6.19 0.5 0.08 6.19 0.5 0.08 6.19 0.5 0.05 6.10 0.5 0.05 6.10 0.5 0.05 6.10 0.5 0.05 6.10 0.7 0.05 6.10 0.8 0.8 0.8 6.10 0.9 0.05 6.10 0.9 0.06 6.10 0.9 0.06 6.10 0.9 0.06 6.10 0.9 0.06 6.10 0.9 0.06 6.10 0.9 0.06 6.10 0.9 0.06 6.10 0.9 0.06 6.10 0.9 0.06			•	
637 0.6 005 643 0.4 005 644 0.4 005 647 0.5 005 648 0.4 005 609 1 0.6 008 619 0.6 008 619 0.5 008 619 0.5 008 619 0.5 008 610 0.5 005 610 0.7 005 610 0.7 005 610 0.7 005 610 0.8 005 610 0.9 005 610 0.9 005 610 0.9 005 610 0.9 005 610 0.9 006 610 0.9 006 610 0.9 006 610 0.9 006 610 0.9 006 610 0.9 006 610 0.9 006 610 0.9 006 610 0.9 006 610 0.9 006 610 0.9 006		Times the tent of the Control of the	3	
647 0.8 005 643 0.48 005 644 0.4 005 645 0.5 008 669 1 0.6 008 619 0.6 008 619 0.5 008 619 0.5 008 619 0.5 008 610 0.5 005 610 0.3 005 610 0.3 005 610 0.3 005 610 0.4 006 614 2 0 06 614 2 006 615 616 0.5 006 616 617 006 618 618 618 618 619 619 006 619 619 618 619 619 606 619 619 619 619 619 606 619 619 606		÷		
0-1 579 0.5 008 0-1 579 0.5 008 4-5 609 1 0.6 008 4-5 0.9 0.8 008 0-1 544 0.5 008 582 0.3 005 596 0.3 005 599 0.2 005 610 0.9 005 610 0.9 005 610 0.9 005 614 2 006 64-5 620 0.5 006 64-5 620 0.4 006 64-5 620 0.5 006	· -	unknown paraliste	້	
647 0.4 0005 0-1 579 0.5 008 4-5 609 1 0.6 008 4-5 0.9 008 6-1 544 0.5 005 582 0.3 005 596 0.3 005 596 0.2 005 599 0.2 007 610 0.9 005 614 2 0.8 006 6-1 544 0.8 006 599 0.2 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007 610 0.9 007	_	docommoic acid	۵	
0-1 579 0.5 008 0-1 609 1 0.6 008 4-5 0.9 0.8 008 4-5 0.9 0.8 008 6-1 544 0.5 005 596 0.2 005 596 0.2 005 599 0.2 005 610 0.9 005 610 0.9 005 610 0.9 005 614 2 008 6-1 544 0.4 006 6-1 544 0.4 006	_	linear hydrocarbon, C-26		
0-1 579 0.5 008 609 1, 0008 619 0.6 008 619 0.6 008 619 0.6 008 619 0.6 0.8 008 610 580 0.5 005 580 0.3 005 596 0.3 005 610 0.3 006 610 0.3 006		hydrocarbon, C-26		
609 1 008 619 0.6 008 619 0.6 008 619 0.6 008 610 0.9 008 610 0.5 005 596 0.3 005 596 0.3 005 610 0.9 005 610 0.9 005 610 0.9 005 610 62 005 620 0.5 006 64-5 580 0.5 006				
4-5 4-5 6-1 544 6-1 545 6-1 546 6-1 546 6-1 546 6-1 546 6-1 6-1 546 6-1 6-1 546 6-1 6-1 6-1 6-1 6-1 6-1 6-1 6		Z-butenedioic acid, bis(Z-	,	
609 1 00R 619 0.6 008 6-5 0.9 008 6-5 0.9 008 6-6 0.9 008 6-7 0.9 005 596 0.3 005 596 0.3 005 599 0.2 005 610 0.9 005 610 0.9 005 610 0.9 005 614 2 006 620 0.9 006 630 0.9 006		methylpropyl) ester	۵	
4-5 636 636 636 636 636 636 637 638 638 638 638 638 638 638 638 638 638		unknown carboxylic acid	۵	
4-5 0-1		unknown carboxylic acid	_	
4-5 0-1 584 0.5 005 582 0.3 005 596 0.3 005 599 0.2 005 610 0.9 005 4-5 544 0.4 006			1	
4-5 0-1				
0-1 \$44 0.5 005 \$82 0.3 005 \$96 0.2 005 \$96 0.2 005 \$99 0.2 005 \$4-5 544 0.4 006 \$99 0.5 006			*	
0-1 \$44 0.5 005 \$82 0.3 005 \$96 0.2 005 \$96 0.3 005 \$99 0.2 005 \$10 0.9 005 \$4-5 \$544 0.4 006 \$4-5 \$544 0.5 006			· ×	
580 0.5 005 582 0.3 005 596 0.2 005 596 0.2 005 599 0.2 005 610 0.9 005 614 2 005 620 0.5 006 54-5 544 0.4 006				
580 0.5 005 582 0.3 005 596 0.2 005 599 0.2 005 610 0.9 005 614 2 005 620 0.5 006 544 0.4 006 580 0.5 006		alkene, C-1/		
582 0.3 005 596 0.2 005 599 0.2 005 599 0.2 005 610 0.9 005 614 2 005 620 0.9 005 620 0.5 006 544 0.4 006 580 0.5 006		2-butenedioic acid, bis(2-methyl		
582 0.3 005 596 0.2 005 599 0.2 005 610 0.9 005 614 2 005 620 0.5 006 544 0.4 006 580 0.5 006		propy1) ester	0	
596 0.2 0.05 596 0.3 0.05 599 0.2 0.05 610 0.9 0.05 614 2 0.05 620 0.5 0.05 544 0.4 0.06 580 0.5 0.06		sulfur	0	
596 0.3 0.05 599 0.2 0.05 610 0.9 0.05 614 2 0.05 620 0.5 0.05 544 0.4 0.06 580 0.5 0.06		4-(2.2.3.3-tetramethyl butv1)		
596 0.3 005 599 0.2 005 610 0.9 005 614 2 005 620 0.5 005 544 0.5 006 580 0.5 006		phenol (or isomer)	862	
599 0.2 0.05 599 0.2 0.05 610 0.9 0.05 614 2 0.05 620 0.5 0.05 544 0.4 0.06 580 0.5 0.06		4-nonv] pheno!	•	
610 0.9 005 614 2 005 620 0.5 005 544 0.4 006 580 0.5 006		4(1.1.1] -terremethy hutvl)	1	
610 0.9 0.05 614 2 0.05 620 0.5 0.05 544 0.4 0.06 580 0.5 0.06		phenol (or isomer)		
610 0.9 0.05 614 2 0.05 620 0.5 0.05 544 0.4 0.06 580 0.5 0.06		TO STATE OF	•	
610 0.9 005 614 2 005 620 0.5 005 544 0.4 006 580 0.5 006		The second and the se	2	
614 2 005 620 0.5 005 544 0.4 006 580 0.5 006				
544 0.5 006 5.8 006 6.5 006		וועשקער פווסור שרוים	3 /	
620 0.5 0.05 0.8 0.4 0.06 580 0.5 0.06		molecular suffur	a	
544 0.4 006 580 0.5 006		octadecanoic acid	c	
544 0.4 0.06 580 0.5 0.06			a	
0.5		. 11	ć	
0.0		dische, C-12		
		2-butenedioic acid, bis(2-methyl		
		propyl) ester	_	
610 0.3 006 CFK		hexadecanoic acid plus an		
		unidentified phthalate	۵, C, ۳	
614 7 006 CFK		molecular sulfur	۵	

B - Surfactant
C - Plasticizer
D - Derived from natural products
F - Low concentration
GT - Greater than
K - None detected

- Values reported are blank corrected

** Sediment grab sample
Site SS-RA

48694/1041A

28

Numerous naturally occurring compounds were found throughout the samples, appearing in grab samples and in samples from borings with equal frequency. These compounds are those tentatively identified as molecular sulfur, hexadecanoic acid, octadecanoic acid, nonanedioic acid, butenedioic acid, docosanoic acid, and associated esters.

Unidentified phthalates (ubiquitous plasticizers) were noted in Boring LS0002 and in Grab Sample MH 65 at a maximum concentration of 0.6 ppm. Phenols were tentatively identified three times in the 0 to 1 ft interval of Boring LS0002 at concentrations of 0.2, 0.3, and 0.2 ppm.

3.2.5 Contamination Assessment

Initial manhole inspection of the railyard and administration areas sanitary sewers showed the manholes to be in fair to good condition. However, previous studies have concluded that the lines were in poor condition and that considerable exfiltration may have been taking place.

Analyses of samples taken from the manhole borings indicated the presence of methylene chloride in just one of the samples. Although this compound was not found in the laboratory blanks for these lots, methylene chloride is used extensively in laboratories. Because this was an isolated occurrence and because methylene chloride is a common laboratory contaminant (it has often been found in blanks even when not found in associated samples), it is probable that its presence at this level is laboratory introduced. Lead and arsenic were each found once within their indicator ranges in the manhole borings. The detected concentrations of these metals are consistent with their natural levels in the soils being analyzed. Lead was detected at the lower limit of its indicator range in sandy soil, and arsenic was detected within its indicator range in sandy clay.

The sampling program also included sediment grab samples from inside five manholes. Samples from MH 50 and MH 65 contained 0.014 and 0.0072 ug/g of dibromochloropropane, respectively. The presence of this pesticide in the

administration area was not anticipated. This compound was detected in only two of the five sediment grab samples and was not found in the manhole boring samples taken from beneath the sewers. As the borings were conducted at "worst-case" manholes (Ebasco, 1987b/RIC 87336R30), the pesticide appears to be contained within the sewer system. Dibromochloropropane was stored in the railyard (Adcock, 1980) and shipped from the railyard area (Sheppard, 1981). It may be possible that it could have entered the sanitary sewer through a sink drain, toilet, or manhole cover, but there is no historic documentation to support this contention. This compound is slightly soluble in water and may have some affinity for the organic matter in the sediments. As noted previously (USAEHA, 1985), wastewater flow through this system is very low. These characteristics are among the factors that determine how fast dibromochloropropane migrates down the sewer line.

Chloroacetic acid was found in three of the samples, at levels of 62, 63, and 65 ug/g. Chloroacetic acid is a possible breakdown product of thiodiglycol, which is a hydrolysis product of mustard. However, thiodiglycol was not detected in any of the samples, indicating that the chloroacetic acid may be from another source. Chloroacetic acid is frequently used as a reagent in organic chemical synthesis, especially in dye synthesis (Snell & Snell, 1962). One of these dyes, indigo, may be used in cleansers and disinfectants for toilets. The presence of these compounds in the sanitary sewer system is highly probable. Chloroacetic acid was detected only in sediment grab samples indicating the compound is contained within the sewer system.

These sediment samples also contained elevated levels of metals, most notably chromium, copper, lead, zinc, and mercury. Chromium was found at concentrations above its indicator range in Samples H2 and R29. Copper was above its indicator range in samples from H2, R29, 50, and 65. Lead was found above its indicator range in samples from H2, R12, R29, and 65. Zinc was also found above its indicator range in samples from H2, R12, R29, and 50. Mercury was above its indicator range in samples from R12, R29, 50, and 65.

Metals form positively charged ions in water that are attracted to ion exchange sites on sediment or soil particles. This exchange or sorption

30

process removes some metals from the solution. If metal compounds or ions were present in the sewer system, the sediment throughout the system would retain elevated levels of those metals. The presence of metals in the sediment inside the sewers, but not in the soil samples collected under the "worst-case" manholes, indicates that these metals are well contained. The only exception to this would be exfiltration points such as breaks in the line or off-set joints. At such a point it is possible, although unlikely, that sediment could escape from the sewer system. Material from the sewers also may be lost periodically at the lift station overflows.

Samples were taken at the overflow discharge points from lift stations 392 and 393. Boring LS0001 (lift station 393) contained copper, zinc, and mercury above its indicator range in the 0 to 1 ft interval. Copper, lead, zinc, and mercury were detected above their indicator ranges in the 0 to 1 ft interval of Boring LS0002 (lift station 392). All target analytes were below their indicator levels in the 4 to 5 ft intervals of the lift station overflow borings.

The nontarget compound analyses indicated the presence of several tentatively identified hydrocarbons. These appeared more often in the grab samples taken from inside the manholes than in samples from borings. These compounds were not chlorinated or brominated, which implies that they are not related to pesticide manufacture. The highest concentration encountered was 0.9 ppm.

Numerous naturally occurring compounds were also detected, but are not of concern in the contamination assessment. The three instances of phthalates, which are commonly used as plasticizers, can be attributed to the polybutyrate tubes and other devices used to collect and analyze the samples. Phenols, tentatively identified in the 0 to 1 ft interval of Boring LS0002, are commonly used as surfactants. These were present at low concentrations.

The semivolatile method, although not certified for volatile compounds, has been shown capable of detecting tetrachloroethylene, toluene, chlorobenzene, ethylbenzene, and xylenes in the nontarget fraction. The absence of these compounds in the nontarget results for this part of the sanitary sewer system is an indication that there is no contamination present from these compounds.

The results of the field investigation indicate that contamination from metals, dibromochloropropane, and chloroacetic acid in the railyard and administration areas is contained within the sewer line or is in the upper 4 ft of the lift station overflow drainage ditches. Of the target compounds identified, dibromochloropropane and chloroacetic acid are the two whose presence was least anticipated. Historical research has not explained the presence of dibromochloropropane in the administration area sanitary sewer. Chloroacetic acid, because of its high solubility, is most probably a recent addition to the system, and its likely source is cleansers and disinfectants used in bathrooms.

3.3 FOLLOW-ON INVESTIGATIONS

Although a worst-case estimate of potential contamination has been delineated, additional work may be needed to more precisely define the extent of potential contamination. If the Feasibility Study determines this additional information is needed, the recommended work will be completed as part of the conceptual or detailed design phase of remedial action to be conducted for the railyard and administration areas sanitary sewer.

The additional work, if it occurs, will consist of:

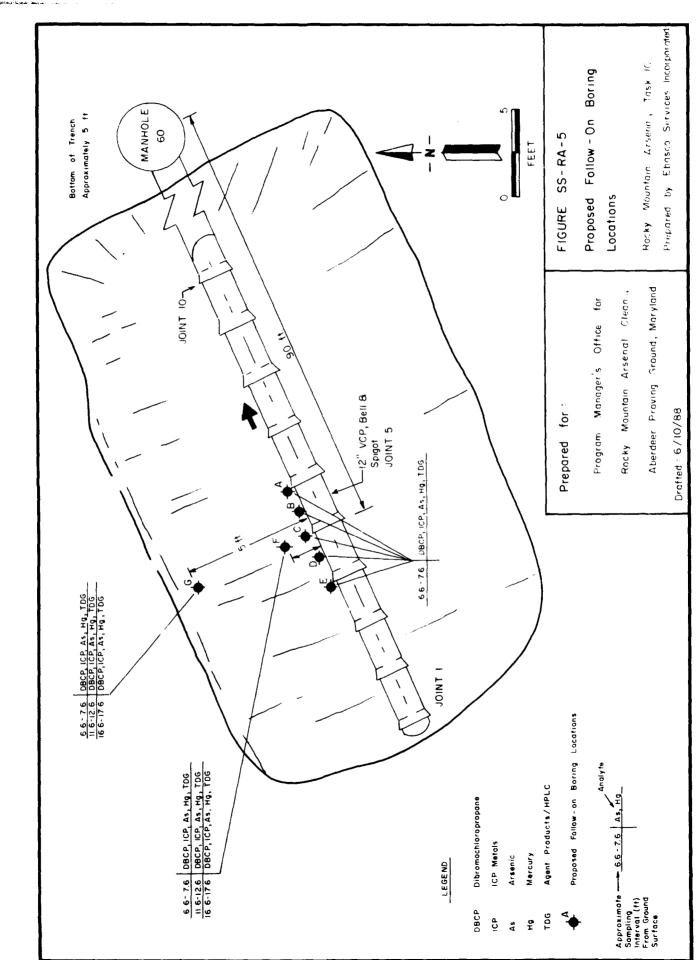
- A dye and excavation study between Manholes 60 and 61. This is the only portion of the pipe in the railyard and administration areas that has been investigated previously and is known to be in poor condition (Black & Veatch, 1980).
- Borings placed beneath and adjacent to the segment of pipe under investigation. Samples from these borings would show if compounds that were found inside the sewer have exfiltrated and migrated away from the pipe.

Analysis of the samples for chloroacetic acid (as part of the Agent Products test) and dibromochloropropane. This information will determine if compounds that were found inside the sewer have exfiltrated to the surrounding soils.

The proposed excavation and dye study should be between Manholes 60 and 61, 90 ft upstream of Manhole 60, because the pipe was found to be in poor condition along this section (Black & Veatch, 1980). This will also be between the manholes where dibromochloropropane was found during the field program (Manholes 50 and 65). Following a previously used method (Ebasco, 1987b/RIC 87336R30), the sewer line would be ; lugged at these two manholes and the connecting line segment filled with a tracer dye solution. After twenty-four hours, the plugs would be removed and the dye allowed to flow downstream in the sewer system. A trench would be dug, exposing about ten joints of the pipe, and the ground inspected for visible areas of staining and/or sediment exfiltration. One joint would then be identified as the worst-case and a sample would be collected from the first foot of soil directly under this joint. Similar samples would be taken from under adjacent joints and haif-way between the center joint and the adjacent joints, yielding a total of five samples. In addition, a boring would be drilled 1 ft out from the center joint and samples taken at 5 ft intervals until the water table is reached. It is anticipated that this boring will yield 8 samples based on the depths to groundwater and to the sewer. A final boring would be drilled 5 ft out from the pipe and samples taken at 5 ft intervals until a depth of 15 ft (below the bottom of the pipe) or the water table is reached. Groundwater is approximately 40 ft below the surface in this area, so the boring would be drilled to 15 ft below the pipe and would yield 4 samples. Figure SS-RA-5 illustrates the proposed follow-on work assuming Joint 5 is identified as the worst-case joint. This follow-on work would result in 7 borings yielding 17 samples. The number of borings and samples to be taken at specific depths are tabulated below.

No. of Borings	Depth Below Sewer (ft)	No of Samples
1	1	5
1	water table	8
1	15	4

Site SS-RA 0063U/0145A Rev. 8/1/88



The number of samples to be tested by each analytical method is listed below.

Analytical Method	No of Samples
Dibromochloropropane (DBCP)	17
ICP Metals	17
Arsenic	17
Mercury	17
Agent Products/High Performance Liquid	
Chromotography	
Chloroacetic Acid	17
Thiodiglycol	17

Comments were received from Shell Oil Company and were considered in the preparation of this final report. EPA comments are an integral part of the report review process, and have been incorporated into this report. Comments and responses are provided in Appendix SS-RA-C.

3.4 QUANTITY OF POTENTIALLY CONTAMINATED MATERIAL

The elevated levels of metals found in this study area were contained in the sediment inside the sewers and at the lift station overflow areas. The volume of potentially contaminated sediment inside the sewers is based on the interior volume of the piping, as described in Section 1.1 of this report, and the interior volume of ninety-six manholes. The manholes are assumed to average 7 ft in depth and 5 ft in diameter, based on the results of the manhole survey. Because the sanitary sewers in the railyard and administration areas are being used far below their design capacity, they are almost empty except for accumulated sediment. Based on visual inspection, the sediment is estimated to occupy no more than 10 percent of the pipe and manhole interior.

In addition, soils at the lift station overflow areas were shown to have elevated levels of mercury in the 0 to 1 ft interval but not in the 4 to 5 ft interval. A conservative volume estimate of potentially contaminated soil at these areas is derived by calculating a volume for a 0 to 4 ft depth over the

surface area of the overflow basins and ditches. The westernmost lift station has an overflow ditch that is roughly 6 by 200 ft, and the eastern lift station has a 3 ft wide and 275 ft long ditch leading to a 20 by 80 ft basin.

The volume of potentially contaminated material is estimated as follows:

Interior volume of piping = 14,000 cubic feet, (ft³)

Estimated sediment volume in piping = 1,400 ft³ (52 cubic yards, yd³)

Interior volume of manholes = 13,000 ft³

Estimated sediment volume in manholes = 1,300 ft³ (48 yd³)

Surface area of lift station overflow ditches = 3,625 ft²

Vertical extent of potential contamination at lift stations = 4 ft

Estimated volume of potentially contaminated soil at lift stations = 14,500 ft³ (540 yd³)

Estimated total volume of potentially contaminated soil = 640 yd³

Results from the field investigation were used to generate a most conservative (worst-case) estimate of the volume of potentially contaminated material associated with the railyard and administration area's sanitary sewer system. This delineation of potential contamination should not be construed to indicate the actual presence of contamination within the volumes outlined. In addition, this approach is not intended to imply that any or all of the material within the potentially contaminated volume must be remediated, nor does it make any assumption about the type of remediation that may be required. Rather, this approach is intended to provide preliminary estimates of the maximum volume of contaminated materials for planning purposes only.

4.0 REFERENCES CITED

Adcock, W.E. 1980. Interoffice memorandum to R.D. Lundahl, July 18, 1980: Irondale contamination. Shell Oil Company. Microfilm RSH845, Frame 1437-1450.

RIC 81266R35

- Black & Veatch. 1979, October. Sanitary sewerage system repairs, Rocky Mountain Arsenal, Commerce City, Colorado. Omaha District COE. G&M 21.
- Black & Veatch. 1980, September. Sanitary sewerage system repairs phase II, Rocky Mountain Arsenal, Commerce City, Colorado. Omaha District COE.
- COE (Corps of Engineers). 1984, June 1. The master plan of Rocky Mountain Arsenal, Colorado. Basic information maps, Drawing No. 18-02-01. U.S. Army Engineer District, Omaha, Nebraska.
- CWS (Chemical Warfare Service). 1945, August 15. History of Rocky Mountain Arsenal 1945 part I. Microfilm RSA008, Frames 597-613.
- DOA (Department of the Army). 1972, May 26. Sanitary sewer lateral from existing Manhole 19 to Building 619, alternate no. 1. Plot plan, profile and manhole details. Rocky Mountain Arsenal, Colorado. Drawing no. E6-6-4.
- Ebasco (Ebasco Services Incorporated). 1987a, October. Final western tier trichloroethylene investigation, technical plan version 3.1, task no. 38. Contract No. DAAK11-84-D-0017. Prepared for Program Manager's Office for Rocky Mountain Arsenal Cleanup.

RIC 87336R30

- Ebasco. 1987b, November. Final technical plan, task no. 10, sewers and process water system investigations. Contract DAAK11-84-D-0017. Prepared for Program Manager's Office for Rocky Mountain Arsenal Cleanup.
- Ebasco. 1987c, December. Draft final contamination assessment report, Site 3-4, nemagon spill area, version 2.3. Contract No. DAAK11-84-D-0017. Prepared for Program Manager's Office for Rocky Mountain Arsenal Cleanup.

RIC 87336R02

ESE (Environmental Science & Engineering, Inc.). 1986a. Introduction to the contamination assessment reports. RMA. Prepared for Program Manager's Office for Rocky Mountain Arsenal Contamination Cleanup.

RIC 86317R01

- ESE. 1986b. Task 4, initial screening program report, v. I, II, and III for Program Manager's Office, Rocky Mountain Arsenal.
- Jones, E. 1987, July 22. Personal communication with Envirosphere employee. RMA10-EDEN-T-075.

RIC 82295R01

- May, J.H. 1982. Regional groundwater study of Rocky Mountain Arsenal, Colorado: Report #1, hydrogeological definition. USAEWES. Microfilm RMA040, Frames 1851-1931.
- Shepherd, W.D. 1981. Interoffice memorandum to W.E. Adcock,
 November 19, 1981: DBCP source investigation Irondale-RMA-project,
 Denver, Colorado. Shell Oil Company. Microfilm RSH859, Frames 0304-0309.
- Snell, F.D. and C.T. Snell. 1962. Dictionary of Commercial Chemicals. D VanNostrand Co., Inc. New York, NY. p. 300.
- Swift, E.W. and C.Y. Chiang. 1987, July. Irondale DBCP control system, Rocky Mountain Arsenal. Review of 1986 operations. Shell Oil Company.
- USAEHA (U.S. Army Environmental Hygiene Agency). 1985, May 30. Water quality engineering study no. 32-66-0154-85, Domestic waste water characterization, Rocky Mountain Arsenal Commerce City, Colorado, 18 March 10 April, 1985. U.S. Army Materiel Command.

RIC 85130R01

USAEWES. 1984. Evaluation of Shell Chemical Company's groundwater DBCP control system at Rocky Mountain Arsenal for the period January 1984 thru September 1984.

RIC 81266R54

- USDA (U.S. Department of Agriculture, Soil Conservation Service). 1974. Soil Survey of Adams County, Colorado.
- WR&SK (Whitman, Requardt & Smith H.A. Kuljian & Co. Engineers). 1942a, July 1. Sanitary outfall sewer for temp. administration area. No. 7164-2002, drawing. As built data added 5/15/43.
- WR&SK. 1942b, July 7. Sanitary collecting sewers for temp. administration area. No. 7164-2001, drawing. As built data added 1/4/43, 7/22/43.
- WR&SK. 1942c, September 19. Depot (storage) area plan 8" sanitary sewer. No. 7164-2010, drawing. As built data added 10/27/42, 11/19/42, 11/26/42, 12/31/42.

Appendix SS-RA-A
Chemical Names
and
Abbreviations

APPENDIX SS-RA-A Chemical Names and Abbreviations

Analytic Methods	Abbreviations
Atomic Absorption Spectroscopy	AA GCCON
Gas Chromatography/Conductivity Detector Gas Chromatography/Electron Capture Detector	GCECD
Gas Chromatography/Flame Ionization Detector	GCFID
Gas Chromatography/Flame Photometric Detector	GCFPD
Gas Chromatography/Mass Spectrometry	GCMS
Gas Chromatography/Nitrogen Phosphorous Detector	GCNPD
Gas Chromatography/Photoionization Detector	GCPID
High Performance Liquid Chromatography	HPLC
Inductive Coupled Argon Plasma Screen	ICP
Ion Chromatography	IONCHROM

PHASE I ANALYTES AND CERTIFIED METHODS SOIL SAMPLES

Analysis/Methods/Analytes	Synonymous Names Used in Appendix B	Abbreviations
AGENT PRODUCTS/HPLC Chloroacetic acid Thiodiglycol	Chloroacetic acid Thiodiglycol (TDG)	TDG CLC2A TDGCL
AGENT PRODUCTS/IONCHROM Fluoracetic acid Isopropylmethylphosphonic acid	Fluoroacetic Isopropylmethylphosphonate	GBDP FC2A IMPA
Methylphosphonic acid	Methylphosphonate	MPA
ANIONS/IONCHROM Chloride Fluoride Sulfate	Chloride Fluoride Sulfate	ANIONS CL FL 504
ARSENIC/AA	Arsenic	<u>A</u> S
DIBROMOCHLOROPROPANE/GCECD	Dibromochloropropane	<u>DBCP</u>
HYDRAZINES/SPECT Hydrazine Methylhydrazine Unsymmetrical dimethyl hydrazine	Hydrazine Methylhydrazine Unsymmetrical dimethyl hydrazine	HYD HYDRZ MHYDRZ - UDMH
MERCURY/AA	Mercury	<u>HG</u>

39

Site SS-RA 0063U/0145A Rev. 8/1/88

APPENDIX SS-RA-A (Continued) Phase I

Analysis/Methods/Analytes	Synonymous Names Used in Appendix B	Abbreviations
METALS/ICP		<u>ICP</u>
Cadmium	Cadmium	CD
Chromium	Chromium	CR
Copper	Copper	cu
Lead	Lead	PB
Zinc	Zinc	ZN
ORGANONITROGEN COMPOUNDS/GCNPD		ONC
n-Nitrosodimethylamine	n-Nitrosodimethylamine	NNDMEA
n-Nitrosodi-n-propylamine	n-Nitrosodi-n-propylamine	NNDNPA
n-Microbodi-n-propyremine	n nitrobodi n propyramine	MAZINI II
ORGANOPHOSPHOROUS COMPOUNDS/GCFPD		OPC
Diisopropylmethyl phosphonate	Diisopropylmethyl phosphonate	DIMP
Dimethylmethyl phosphonate	Dimethylmethyl phosphate	DMMP
SEMIVOLATILE ORGANIC COMPOUNDS/		411 0
GCMS		<u>svo</u>
1,4-0xathiane	1,4-0xathiane	OXAT
<pre>2,2-bis(Para-chloropheny1)- 1,1-dichloroethane</pre>	Dichlorodiphenylethane	PPDDE
2,2-bis(Para-chlorophenyl)-	Dichlorodiphenyltrichloro-	PPDDT
1,1,1-trichloroethane	ethane	
Aldrin	Aldrin	ALDRN
Atrazine	Atrazine	ATZ
Chlordane	Chlordane	CLDAN
Chlorophenylmethyl sulfide	p-Chlorophenylmethyl sulfide	CPMS
Chlorophenylmethyl sulfone	p-Chlorophenylmethyl sulfone	CPMS02
Chlorophenylmethyl sulfoxide	p-Chlorophenylmethyl sulfoxide	CPMSO
Dibromochloropropane	Dibromochloropropane	DBCP
Dicylopentadiene	Dicyclopentadiene	DCPD
Dieldrin	Dieldrin	DLDRN
Diisopropylmethyl phosphonate	Diisopropylmethyl phosphonate	DIMP
Dimethylmethyl phosphonate	Dimethylmethyl phosphonate	DMM P
Dithiane	Dithiane	DITH
Endrin	Endrin	ENDRN
Hexachlorocyclopentadiene	Hexachlorocyclopentadiene	CL6CP
Isodrin	Isodrin	ISODR
Malathion	Malathion	MLTHN
Parathion	Parathion	PRTHN
Supona	2-Chloro-1 (2,4-dichlorophenyl)	SUPONA
- "F """	vinyldiethyl phosphates	
Vapona	Vapona	DDVP

APPENDIX SS-RA-A (Continued) Phase I

Analysis/Methods/Analytes	Synonymous Names Used in Appendix B	<u>Abbreviations</u>
VOLATILE ORGANIC COMPOUNDS/ GCMS 1,1-Dichloroethane	1.1-Dichloroethane	VO 11DCLE
1,2-Dichloroethane	1,2-Dichloroethane	12DCLL
1,1,1-Trichloroethane	1,1,1-Trichloroethane	LIITCE
1,1,2-Trichloroethane	1,1,2-Trichloroethane	112TCE
Benzene	Benzene	C6H6
Bicycloheptadiene	Bicycloheptadiene	BCHPD
Carbon tetrachloride	Carbon tetrachloride	CCL4
Chlorobenzene	Chlorobenzene	CLC6H5
Chloroform	Chloroform	CHCT3
Dibromochloropropane	Dibromochloropropaue	DBCP
Dicyclopentadiene	Dicyclopentadiene	DCPD
Dimethyldisulfide	Dimethyldisulfide	DMDS
Ethylbenzene	Ethylbenzene	ETC6H5
m-Xylene	m-Xylene	13DMb
Methylene chloride	Methylene chloride	CH2CL2
Methylisobutyl ketone	Methylisobutyl ketone	MIRK
o- and p-Xylene	Ortho- & Para-xylene	XYLEN
Tetrachloroethylene	Tetrachloroethene	TCLEE
Toluene	Toluene	MEC6H5
Trans-1,2-dichloroethylene	Trans-1,2-dichloroethene	T12DCE
Trichloroethylene	Trichloroethene	TRCLE

APPENDIX SS-RA-A Phase II

PHASE II ANALYTES AND CERTIFIED METHODS SOIL SAMPLES

Analysis/Methods/Analytes	Synonymous Names Used in Appendix B	Abbreviations
AGENT PRODUCTS/GCMS Diisopropylaminoethanethiol Dimethyl arsenous acid Methyl aronic acid Tributylamine	Diisopropylaminoethanethiol Dimethyl arsenous acid Methyl aronic acid Tributylamine	LEWDP DIAET ME2AEA MEAOA TBA
AGENT PRODUCTS/HPLC (Same as Phase I)		T DG
AGENT PRODUCTS/IONCHROM (Same as Phase I)		GBDP
ANIONS/IONCHROM (Same as Phase I)		ANIONS
ARSENIC/AA	Arsenic	AS
DIBROMOCHLOROPROPANE/GC	Dibromochloropropane	DECF
FLUORIDE/ISE	Fluoride	<u>F</u>
HYDRAZINES/SPECT (Same as Phase I)		<u>H</u> YD
MERCURY/AA	Mercury	H C
METALS/ICP (Same as Phase I)		ICP
ORGANO-ARSENIC	Organo-arsenic	ORGAS
ORGANOCHLORINE PESTICIDES/GCECD 2,2-bis(Para-chloropheny1)-	Dichlorodiphenylethane	<u>OCP</u> PPDDE
1,1-dichloroethane 2,2-bis(Para-chloropheny1)-	Dichlorodiphenyltrichloro- ethane	PPDDT
1,1,1-trichloroethane Aldrin	Aldrin	ALDRN
Chlordane	Chlordane	CLDAN
Dibromochloropropane	Dibromochloropropane	DBCP
Dieldrin	Dieldrin	DLDRN
Endrin	Endrin	ENDRN CL6CP
Hexachlorocyclopentadiene Isodrin	Hexachlorocyclopentadiene Isodrin	ISODR

APPENDIX SS-RA-A (Continued) Phase II

Analysis/Methods/Analytes	Synonymous Names Used in Appendix B	Abbreviations
ORGANO-MERCURY	Organo-mercury	ORCH G
ORGANONITROGEN COMPOUNDS/GCNPD (Same as Phase I)		<u>O</u> NC
ORGANOPHOSPHOROUS COMPOUNDS/GCFPD (Same as Phase I)	-	OPC
ORGANOPHOSPHORUS PESTICIDES/ GCNPD		QPP
Atrazine	Atrazine	ATZ
Malathion	Malathion	MLTHN
Parathion	Parathion	PRTHN
Supona	2-Chloro-1 (2,4-dichlorophenyl) vinyldiethyl phosphates	SUPONA
Vapona	Vapona	DDVP
ORGANOSULPHUR COMPOUNDS/GCFPD 1,4-Oxathiane	1,4-0xathiane	OSC OXAT
Chlorophenylmethyl sulfide	p-Chlorophenylmethyl sulfide	CPMS
Chlorophenylmethyl sulfone	p-Chlorophenylmethyl sulfone	CPMS02
Chlorophenylmethyl sulfoxide	p-Chlorophenylmethyl sulfoxide	CPMS0
Dimethyldisulfide	Dimethyldisulfide	DMDS
Dithiane	Dithiane	DITH
SEMIVOLATILE ORGANIC COMPOUNDS/		
		svo
GCMS (Same as Phase I)		<u>500</u>
VOLATILE AROMATIC ORGANIC		
COMPOUNDS/GCPID		<u>VAV</u>
Benzene	Benzene	C6H6
Ethylbenzene	Ethylbenzene	ETC6H5
m-Xylene	m-Xylene	13DMB
o- and p-Xylene	Ortho- & Para-xylene	XYLEN
Toluene	Toluene	MEC6H5
VOLATILE HALOGENATED ORGANIC		****
COMPOUNDS/GCCON	1 1 05-61	VHO
1,1-Dichloroethane	1,1-Dichloroethane	11DCLE
1,2-Dichloroethane	1,2-Dichloroethane	12DCLE
1,1-Dichloroethene 1,1,1-Trichloroethane	1,1-Dichloroethene	11DCE 111TCE
1,1,1-Irichloroethane 1,1,2-Trichloroethane	1,1,1-Trichloroethane 1,1,2-Trichloroethane	
1,1,2-iriculoroethane	1,1,2-111CHIOTOETHANE	112TCE

APPENDIX SS-RA-A (Continued) Phase II

Analysis/Methods/Analytes	Synonymous Names Used in Appendix B	Abbreviations
VOLATILE HALOGENATED ORGANIC		
COMPOUNDS/GCCON (Continued)		
Carbon tetrachloride	Carbon tetrachloride	CCL4
Chlorobenzene	Chlorobenzene	CLC6H5
Chloroform	Chloroform	CHCL3
Methylene chloride	Methylene chloride	CH2CL2
Tetrachloroethylene	Tetrachloroethene	TCLEE
Trans-1,2-dichloroethylene	Trans-1.2-dichloroethene	T12DCE
Trichloroethylene	Trichloroethene	TRCLE
VOLATILE HYDROCARBON COMPOUNDS/		
GCFID		HYDCBN
Bicycloheptadiene	Bicycloheptadiene	BCHPD
Dicyclopentadiene	Dicyclopentadiene	DCPD
Methylisobutyl ketone	Methylisobutyl ketone	MIBK
VOLATILE ORGANIC COMPOUNDS/GCMS		<u>v</u> o
(Same as Phase I)		



APPENDIX SS-RA-B

Chemical Data

The analytical results of the laboratory analysis of soil samples collected as part of the program comprise the first part of Appendix SS-RA-B. Data are listed sequentially by boring number and successive depths below the surface. Within each depth, all analytes for which the samples were tested are listed alphabetically. Results are given as less than (LT) the detection limit for the test laboratory, or as detected concentrations above this limit. Based on the accuracy of laboratory test methods, values for volatile and semivolatile compounds are considered accurate to one significant figure, values for dibromochloropropane when tested separately and for metals are considered accurate to two significant figures.

The second part of Appendix SS-RA-B contains data from the blanks associated with the analytical work. Blanks for the soil samples were based on a homogenized subsample of composited samples from a known uncontaminated soil that is stratigraphically similar to the RMA soils. Blanks for the water samples were based on distilled water. Control samples, or blanks, are introduced into the train of environmental samples to function as monitors on the performance of the analytical method. These samples function as quality control (QC) samples, and are an integral part of the quality assurance (QA) program for the project. The method blanks listed in this Appendix were utilized to verify that the laboratory was not a source of sample contamination. If contamination were detected in a method blank, corrective actions were taken to assure that reported concentrations of target analytes reflected sample analytes, and not analytes introduced by the laboratory process.

45

Site SS-RA 0063U/0145A Rev. 8/1/88

7esk 10

Summary of Analytical Results Ebasco Services Incorporated

Major Majo	Boring Number	Depth (ft)	Semple	Analytical Parameters	Results	•	Grifts	Sample Number
Araenic Atracine Chioroscetic Acid Chloroscetic Acid Chloroscetic Acid Chloroscetic Acid Chlorophenylmethyl Sulfide D-Chlorophenylmethyl Sulforde LT 2 Chromium Chrom	0340000H2	5.2	5011	Aldrin	LT 3	-01	0/00	8XH004
cline Lum chlorocyclopentadiene Lum lorophenylmethyl Sulfide lorophenylmethyl Sulfoxide Lum mium mium mium mium clopentadiene lorophenylmethyl Phosphonate Lum lum lum lum lum lum lum lum	i	ı		Arsenic	2		0/00	BXD014
chlorocyclopentadiene chlorocyclopentadiene chlorophenylmethyl Sulfide lorophenylmethyl Sulfide lorophenylmethyl Sulfore lorophenylmethyl Sulfore chlorophenylmethyl Sulfore mium mium mium chlorophenylmethyl Phosphonate chlorocylmethyl Phosphonate chlorocylmethyl Phosphonate chlorocylmethyl Phosphonate chlorocylmethyl Phosphonate chlorocylmethyl Phosphonate chlorocylmethyl Chlorophenyl chlorocylmethyl Chlorophenyl chlorocylmethyl Chlorophenyl chlorocyllorophenyl chlorocyllorophenyl chlorocyllorocylenyl chlorocyllorocyl chlorocyllorocylenyl chlorocyllorocylenyl chlorocyllorocylenyl chlorocyllorocylenyl chlorocyllorocylenyl chlorocyllorocyl chlorocyllorocylenyl chlorocyllorocyl chlorocyl chlorocyllorocyl chlorocyl				Atrazine			0/07	BXHOD4
chlorocyclopentadiene chlorocyclopentadiene locophenylmethyl Sulfide lorophenylmethyl Sulfoxide lorophenylmethyl Sulfoxide lorophenylmethyl Sulfoxide lorophenylmethyl Sulfoxide wium mium				Codmium			0/07	8X I 007
lorophenylmethyl Sulfide LT 2 Lorophenylmethyl Sulfide LT 3 Lorophenylmethyl Sulfore LT 3 Lorophenylmethyl Sulfore En 4.0 En 6.0 En 6.0 En 6.0 En 6.0 En 7 En 7 En 7 En 8 En 6.0 En 7 En 8 En 7 En 8 En 8 En 8 En 8 En 8 En 8 En 9				Hexachlorocyclopentadiene		-01	0/00	BXH004
lorophenylmethyl Sulfide lorophenylmethyl Sulfide lorophenylmethyl Sulforde lorophenylmethyl Sulford mium er clopentadiene lorophenylmethyl Phosphonate loropylmethyl Phosphonate loropylmethyl Phosphonate lorofylmethyl Phosphonate lorofylmethylethane lorodiphenylethane lorodiphenylethane lorodiphenyltrichloro- lorodiphenyltrichlorophenyl) lorodiphenyltrichlorophenyl) lorodiphenyltrichlorophenyl) lorodiphenyltrichlorophenyl) lorodiphenyltrichlorophenyl) lorodiphenyltrichlorophenyl) lorodiphenyltrichlorophenyl) lorodiphenyltrichlorophenyl) lorodiphenyltrichlorophenyl)				Chlorogestic Acid	6.2		0/00	BXE007
lorophenylmethyl Sulfide LT 3 lorophenylmethyl Sulforide LT 3 lorophenylmethyl Sulfore LT 3 en en encenicopropene LT 5.0 encentadiene LT 5.0 encenicopropene LT 1 lane drin LT 5.0 LT 6.0 LT 6.0 LT 6.0 LT 6.0 LT 6.0 LT 6.0 LT 7 LT 6.0 LT 7 LT 6.0 LT 7 LT 6.0 LT 7				Chlordene			0/00	BXH004
lorophenylmethyl Sulforde LT 3 lorophenylmethyl Sulfone LT 3 en en choochloropropane clopentadiene LT 3 clopentadiene LT 3 clopentadiene LT 1 lane drin LT 3 in LT 3 in LT 3 in LT 4 drin LT 5.0 LT 5 lorodiphenylethane LT 6 LT 5 LT 5 LT 6 LT 7 LT 5 LT 5 LT 6 LT 7 LT 5 LT 6 LT 7 LT 5 LT 7 LT 5 LT 6 LT 7 LT 6 LT 7 LT 6 LT 7 LT 6 LT 7 LT 7 LT 6 LT 7 LT 6 LT 7 LT 7 LT 7 LT 6 LT 7 LT 6 LT 7 LT 6 LT 6 LT 7 LT				heny lmethy 1		-01	0/00	BXH004
Iorophenyimethyl Sulfone LT 3 er er er er er cmochloropropane clopentadlene clopentad						-01	0/00	BXH004
er 6.0 er 6.0 er 6.0 er 6.0 er 6.0 er 7.1 er 1.1 er 1.1 er 1.2 er 1.2 er 1.2 er 1.2 er 1.2 er 1.3 er 1.2 er 1.1 er 1.3 er 1.1 er 1.1						-01	8/60	8XH004
omochloropropane be omochloropropane clopentadiene clopentadiene clopentadiene lt 3 opropylmethyl Phosphonate lt 1 lane drin lane drin lt 5 lt 6 lorodiphenylethane lt 6 lorodiphenyltrichloro- thion lt 6 lorodiphenyltrichloro- lorodiphenyltrichloro- lorodiphenyltrichloro- lorodiphenyltrichloro- lt 6 lorodiphenyltrichlorophenyl) lt 6 lt				SOUTH THE STATE OF	5.0		0/00	BX1007
omochloropropane clopentadiene clopentadiene clopentadiene clopentadiene LT 3 baropylmethyl Phosphonate LT 4 drin lane drin LT 5 LT 6 LT 7 LT 7				Copper	0.4		0/00	8X1007
omochloropropene LT 3 clobentadiene LT 1 lane defin LT 3 in LT 3 in LT 3 in LT 3 in LT 5 LT 7 LT 5 LT 7 LT 6 LT 7				Dibromochloropropane			0/05	BXF007
clopentadiene clopentadiene lt 3 bare durin lt 1 lt 4 drin lt 3 lt 4 lt 1 lt 4 lt 1 lt 4 lt 1 lt 1 lt 2 lt 1 lt 3 lt 3 lt 4 lt 1 lt 3 lt 3 lt 4 lt 1 lt 3 lt 4 lt 1 lt 4 lt 1 lt 1 lt 1 lt 2 lt 3 lt 3 lt 4 lt 1 lt 4 lt 1 lt 1 lt 1 lt 2 lt 1 lt 3 lt 3 lt 4 lt 4 lt 4 lt 4 lt 1 lt 1 lt 4 lt 1 lt 4 lt 1				Dibromochloropropane			0/00	BXH004
LT 3 lene lene lene lene lene lene lene len				Dicyclopentadiene		00+	0/00	8XH004
beropylmethy! Phosphonate LT 1 lane drin drin lry lry lry lorodiphenylethane LT 6 LT 3 LT 3 LT 3 LT 5		•			#7 	Ģ	9/00	BXHOO4
derin LT 4 derin LT 3 LT 3 LT 3 LT 5.0 LT 7				Di (approprimethy) Phosphopata		2	0/011	ACCHXE
definition LT 5.0 LT 6.9 LT 6.9 LT 6.0 LT						3 6	3	100 TX
in LT 5.0 Lorodiphenylethane Lorodiphenylethane Lorodiphenylethane LT 6 LT 9 LORODIPHENYLETCHIOCOPHENYL LT 9 LORODIPHENYLETCHIOCOPHENYL LT 9 LORODIPHENYL PHOSPHATES LT 4.2 LT 4.2						į į	0/07	RXHOOA
thion Oxathiane Oxathiane LT 3 Oxathiane LT 3 LT 3 LT 7 Oxathiane LT 6 Lorodiphenylethane LT 6 Lorodiphenyltrichloro- LT 6 LT 7 LT 6 LT 6 LT 6 LT 7 LT 6 LT 6 LT 6 LT 7 LT 6 LT 7 LT 6 LT 7 LT 6 LT 6 LT 7 LT 6 LT 6 LT 7 LT 6 LT 7 LT 6 LT 6 LT 7 LT 7 LT 6 LT 7 LT 6 LT 7 LT 6 LT 7 L				Endrin		-01	0/00	BXH004
LT 5.0 -in Lin Lt 3 Chathlane Lorodiphenylethane Lorodiphenyltrichloro- Lorodiphenyltrichloro- Lorodiphenyltrichloro- Loro-1(2,4-Dichlorophenyl)							•	,
thion Uncodiphenylethane Lorodiphenylethane Lorodiphenyltrichloro- Lorodiphenyltrichloro- Lorodiphenyltrichloro- Lorodiphenyltrichloro- Lorodiphenyllrichlorophenyl) Lorodiphenyllrichlorophenyll Lorodiphenyll				Mercury			0/00	9009XE
Oxathlane Lorodiphenylethane Lorodiphenylitichloro- Lorodiphenylitichloro- Lorodiphenylitichloro- Lorodiphenylitichlorophenyl) Lorodiphenyl Phosphates Lorodiphenyl Phosphates Lorodiphenyl Phosphates Lorodiphenyl Phosphates Lorodiphenyl Phosphates						7 5	0 0	AXHOOK A
lorodiphenylethane LT 6 LT 5 ane LT 9 LOROGIPHENYLITICHIONO- LT 9 LOROGIPHENYLI PHOSPHATES LT 6				1 - 4 - 0 x = th dens		; ç	0/00	BXHO04
lorodiphenylethane LT 6 LT 5 ane LT 6 LT 9 Lhion Loro-1(2,4-Dichlorophenyl) LT 6 yidlethyl Phosphates LT 4.2 diglycol				Lead	ė		0/00	6×1007
thion thion local(2,4-Dichlorophenyl) LT 6 yldlethyl Phosphates diglycol 1.2				to the state of th		į	0/81	ACHUMA
thion LT 9 Loro-1(2,4-Dichlorophenyl) LT 6 yldlethyl Phosphates diglycol LT 6.2				Dichlorodiphenyltrichloro-		ő	0/00	BXH004
LT 9 loro-1(2,4-Dichlorophenyl) LT 6 yldlethyl Phosphates diglycol 1.2				ethane			;	
loro-1(2,4-Dichlorophenyl) LT 6 yldlethyl Phosphates diglycol LT 4.2				Parathion		-01	0/00	BXH004
yidiethyl Phosphates digiycol 1.2				2-Chloro-1(2,4-Dichlorophenyl)		-01	0/00	BXHD04
digiyeol LT 4.2				Vinyidiethy! Phosphates				
1.2				Thiodigiycol			0/00	BXE007
				Zinc	1.2		0/00	8×1007
		1	;	•		1	,	

Rocky Mountain Arsenal Program 08/01/88	Sanitary Severs Rail Yard & Administration
Ŏ.	Task 10
Ebasco Services Incorporated	Summery of Analytical Results

Depth (ft)

Boring

8.5-9.5

1004 000R17

	Í	•		4771	
Anglyting Tenesation		results	.	euro I	NOMBO
1,1,2-Trichloroethane	۲,	#)	-0	0/00	BSR007
1,1-Dichloroethene	۲٦	0	-01	0/00	BSR007
1.2-Dichloroethene	7	m	-01	0/00	BSR007
1,2-Dichloroethane	-	m	-01	0/00	BSR007
m-Xylene	ר	^	- 0	8/8 0	85R007
Aldrin	1	۲ì	-01	0/60	890008
Arsento	7	'n.	00+	0/00	BSH020
Atrozine	ב	*	-01	0/00	850008
Bicycloheptadiene	ב	P)	-01	0/00	BSR007
Benzene	LT	n	- 0	0/60	BSR007
Carbon Tetrachloride	11	P)	-01	0/00	BSR007
Codmitum	٦,	7.3	10 -	0/00	855017
Methylene Chloride	ב	^	-01	0/00	85R007
Chloroform	ב	М	-01	0/00	85R007
Hexachlorocyclopentadiene	ב	•	-0 1	0/0 n	820008
Chlorobenzene	ב	r)	-01	0/00	BSR007
Chlordane	ב	8	Ç	B/Bn	820008
p-Chlorophenyimethyl Sulfide	ב	•	-01	0/00	820008
p-Chlorophenyimethyl Sulfoxide	11	•	٠٥	8/80	BSUGOB
p-Chlorophenylmethyl Sulfone	1	m	-01	0/00	830008
Chromium	11	6.5	00+	8/80	889017
Copper	L	4.7	8	0/07	885017
Olbromech] oropropane	ב	4	-01	0/60	65R007
Dibromochloropropane	<u>۱</u>	r)	-01	0/00	5 3000 6
Dicyclopentadiene	ב	-	₽	0/00	880008
Dicyclopentadiene	1.1	m	-01	0/00	89R007
Vapona	1	۳	00	D/00	820008
Diisopropylmethyl Phosphonate	-	~	00+	0/00	BSU008
Dithiane	1	4	ō	9/00	BSU008
Dieldrin	L 1	m	- 01	0/00	820008
Dimethyldisulfide	17	6 0	-01	0/60	BSR007
Endrin	ב	s	-01	6/6 0	830008
Ethy!benzene	ב	r)	-01	0/00	85R007
Mercury	_	מ	ć	1	4000

Ebasco Serv	Ebasco Services Incorporated	Bted	Rocky Mountain Arsenal Program	Program				08/01/88	
Summery of Analytica	-	Results	Task 10 Senitary Severs Reil Yerd & Administration	ers	Re11	P.a.	Admini	stration	
Boring	Depth (ft)	Sample	Anslytical Parameters		Results		Unita	Sample Number	}
100400017	6 6 8	1,108	Table	1	*1	Ō	0/00	890008	
1 v000 100 1		•••	Toluene	5	m	10-	0/05	BSR007	
			Methylisobutyl Ketone	רן	P)	-01	0/Bn	BSR007	
			Melethion	֓֞֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֡֓֓֓֡֡֓֓֓֓֡֡֓֓֡֓֡	~ "	Ģ	0/07	#S(V)008	
			1,4-Oxethiene	Ĵ		7	0 (0)	900068	
			C+84		2.4	10+ 1	0/80	699017	
			Dichlorodiphenylethane	ב	•	Ģ	0/00	890068	
			Dichlorodiphenyltrichloro-	1	K O	-01	0/07	82008	
			ethane	•	•	,	7		
			Parathion	י ני		Ģ i	0 0	90000	
			2-Chloro-1(2,4-Dichlorophenyi) Vinyldiethyl Phosphates	آ	0	6	0	BSCOOR	
			Tetrachloroethene	-	•7	10-	09/9	634007	
			Things you	1			0/00	SEACO9	
			Trichloroethere	נ' ;			0/00	65R007	
			Ortho- & Pers-Xylene	ני		-01	0/05	858007	
			Zinc		N.	5 +01	0/00	898017	
					,	i	•		
1004000R17	12.5-13.5	5011	1,1,1-Trichloroethene	֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֖֡֓֓֓֓	*) •	0	0/00	65/2008	
			1, 1, 2~ Trichloroethene			5	0/60	BSR008	
			1,1-Dichloroethene	35		֖֡֞֞֝֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓	0 0		
			1,2-Dichloroethane	ב' נ		-0.5	0/07	BSROOB	
						i	•		
			a-Xvlere	۱. ا		i i	0/07	90026	
			Aldrin	· ·	o :	5 §	0 (0)	890004	
			A186110	- 1		֡֝֟֝֟֝֓֓֟֝֟֓֓֓֓֓֓֓֓֓֓֓֟֟֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓) (c)	ASLID19	
			Bicycloheptadiene	ב :	•	i p	0/07	BSRDOB	
			Benzene	-		-01	0/00	898008	
			Carbon Tetrachloride	-1	m		0/00	898008	
				1	ζ.	3 -01	0/00	655018	
			Methylene Chloride	<u>.</u>	^ '	, 10,	0/00	898008	
			Chloroform	S		ő	0 00	65K006	
			Hexachlorocyclopentadiene	11	•	-01	0/00	600198	

Note: Results for some parameters may appear in nore than one analytical fraction.

Promite and Promit

85U009

0/07 0/6n

ç ç

ethene Parathion 2-Chloro-1(2,4-Dichlorophenyl) Vinyldiethyl Phosphates Tetrachloroethene

BSROOB

-01

٦

BBA010 BSR008

0/0n

2.5 +00 3 -01

בין

Thiodigizeol Trichloroethene

Ebasco Services	ses Incorporated	ated	Rocky Mountain Arsenal Program	ogram			08/01/88
Summery of Analyt	malytical Results	suits	Tosk 10 Senitery Severs Reil Yerd & Administration	.s Rail	P	& Admini	stration
Boring	Depth (ft)	Sample	Analytical Peremeters	Results	lt s	Units	Semple Number
1004000R17	12.5-13.5	Sofi	Chlorobenzene Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfoxide p-Chlorophenylmethyl Sulfoxide	LT L	10000000000000000000000000000000000000	00000	88.R008 88.U009 85.U009 85.U009
			Chromium Copper Dibrowochloropropane		6.5 +00 4.7 +00	0/00	855018 855018 857008
			Dibromochioropropane Dicyclopentadiene	11	o o	0/00	898008
			Dicyclopentadiene Vapone Difeomobylaethy! Phosphoste		8 9 5	0/07	850009 850009 851009
			Dithiane		5 5	0/00	600058 600058
			Dimethyldisulfide Endrin Ethylbenzene Mercury Isodrin	11 11 11 11 12 13 13 13 13 13 13 13 13 13 13 13 13 13	8 -01 3 -01 3 -01	00000	850009 850009 857008 857006 850009
			Toluene Methylisobutyl Ketone Melathion 1,4-Oxathiane Lead	11111111111111111111111111111111111111	3 -01 3 -01 3 -01 8 3 +00	99999	858008 858008 859009 859018
			Dichlorodiphenylethene Dichlorodiphenyltrichloro-	LT 6	<u>0</u> 0	0/00	600058

Í

Program
Arsene]
Mountein
Rocky

Sanitary Severs -- Rail Yard & Administration

Ebasco Services Incorporated

Boring	Depth (ft)	Sample Type	Anslytical Parameters	K	Results	_ [Units	Sample Number
7 1 8000 000	12.5-13.5	5011	Ortho- & Pars-Xylene	۲	30 (Į į	0/00	BSROOS
71 WOOD #0		 	Zinc		2.2	10+	9/90	910669
	,	1700	4.4	ב	•>	-01	0/00	8XHO02
1003000829	7 .	1100	A74651		8.4	80	0/00	6 X0012
				٦	m	10-	0/00	8×1002
					1.8	8	0/00	8X1005
			Hexachlorocyclopentadiene	ר	•	- 0	0/00	BXH002
								1000
			Chloroscetic Acid		4.4	+01	0/00	BXEOOS
			Chiodene	-	~	Ş	0/00	EXMOD?
			propherylmethyl Sulfide	-	0	1 0	0/07	BXHOOS
				-1	m	õ	D/00	BXH002
				ר	m	-01	0/05	BXHO02
							7	100.74
			Chromitum		0.0		0 \ 0 2	SOUT X S
			Chaper		9.0		0 / 0 / 0	COOTXS
			Dibromochloropropene	1	F)		0/05	BXHOOZ
			Discounce I propropere	-1	5.0		0/00	BXF005
			Dicyclopentadiene	7	=	00+	0/00	BXH002
					•	(-/	2007
			Vapona	- 1	n .	5	9 1	
			Diisopropylmethyl Phosphonate	_	-	Q	0 / 0 7	SAMOOL
				L1		7 0-	0/00	BXHOOZ
			21-10-10	7	n	ō	0/05	SXHOOZ
			Endrin	11	¥D.	-01	0/00	B XH002
					0	ç	0/00	8WX020
			Mercury	-			0/00	6 XH002
			Isodrin	· •	, ,	֡֟֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓	0/011	8XH002
			Melathion	٠,		i	0/01	WXHOO2
			1,4-Oxathiane	נ	,			EV TOOR
			Lead		٥.	*07		2014
				1.1		-01	0/00	BXH002
			Dichionodiphenyltrichloro-	ב	ĸ	-01	0/00	8XHD02
				1	۰	-01	3/00	BXH002
			2-chloro-1(2,4-Dichlorophenyl)	۳.	ø	-01	0/00	8×H002
			vinvidiathy! Phosphates					

00000

ני

۲

p-Chlorophenylmethyl Sulfone Chromium

Copper Dibromochloropropane Dibromochloropropane 650010 858009 850010 850010

0/0/00

Dicyclopentadiene Dicyclopentadiene Vabona Diisopropylmethyl Phosphonate Dithiane 850010 85R009

0/00

-01

11

Dieldrin Dimethyldisulfide

Ebasco Services	ices Incorporated	ated	Rocky Mountain Arsenal Program	rogram				08/01/88
Summery of Analyt	Analytical Results	sults	Tesk 10 Sanitary Sewers Rail Yard & Administration	ř 1	1 1	Vard (Admini	stration
Boring	Depth (ft)	Sample	Analytical Parameters	٤	Results		Unita	Sample Number
1003000R29	7.9	Soli	21nc		1.6	1.6 +02	0/60	6X1005
1003000R30	5,5-6,5	Soil	1,1,1-Trichloroethane	11	*)	-01	0/00	BSR009
			1,1,2-Trichloroethene	בי	n c	Ģ	0/00	85R009
			1.1-Dichionosthers	ב ב	P 107	Ģ	0 0	B3R009
			1,2-Dichloroethane	בֿוֹ	*	Ģ	0/00	BSR009
			E-X / 1010	11	^	10-	0/00	BSR009
			Aldrin	-1	n	-01	0/00	890010
			Arsenic	-1	٠.	ô	0/00	55H022
			Atrazine	1	M	ņ	0/05	550010
			Bicycloheptadiene	-1	n	-01	0/00	BSR009
			Benzene	11	m	-01	0/00	898009
			Carbon Tetrachloride	-1	М	-01	0/00	BSR009
			Cadatum	1	7.3		0/0n	855019
			Methylene Chloride	۲,	^	-01	0/00	698009
			Chloroform	1	P	-01	0/00	BSR009
			Hexachlorocyclopentadiene	רי	•	-01	0/00	650010
			Chlorobenzene	L1	m	٠ 1	0/60	BSR009
			Chlordene	1	~	00+	0/00	850010
			p-Chlorophenylmethyl Sulfide	רין	•	<u>-</u> 0	0/00	850010
			p-Chlorophenylmethyl Sulfoxide	11	m	-01	0/00	BSU010

(

Ebasco Services Incorporated

Depth (ft)	Sample	Anglytical Parameters	Results	Unite	Semple Number
		E codes (0-	9/91	
0.0-6.0	1100	Ethylbenzene) P)	_	898009
		Mercury	5.0		B\$1007
		Isodrin	۳ì	1 00/0	690010
		Toluene			89R009
		Methy 14obuty Ketone	LT 3 -01	1 00/0	BSR009
		Majathion	^		890010
		1.4-0xethiere	ø)		890010
		Lead	2.2		855019
		Dichlorodipheny lethans	LT 6 -01	1 00/0	690010
		Dichlorodiphenyltrichloro-	LT 5 -01	1 09/9	880010
		ethane			!
		Perathion	o		690010
		2-Chloro-1(2,4-Dichlorophenyl)	LT 6 -01	1 00/0	880010
		Vinyidiethyl Phosphates	, T	0/01.	
		Thiodigiyesi	2.5		BBA 011
		Trichloroethene		00/0	BSR009
		Ortho- & Para-Xvlene	P)		BSR009
		Zinc	4.2		895019
9.5-10.5	5011	1.1.1-Trichloroethene	LT 3 -01	1 00/0	69R01 0
		1,1,2-Trichloroethane	LT 3 -01	1 00/0	BSR010
		1,1-Dichloroethene			BSR01 0
		1,2-Dichloroethene	LT 3 -01	1 00/0	85R010
		1,2-Dichloroethane	LT 3 -01	1 00/0	BSR01 0
		Aldrin	LT 6 -01	1 00/0	88000
		Arsenic	LT 5. +00	0/00 0	BSH023
		Atrazine	LT 3 +00	0/00 0	630002
		Bicycloheptadiene		1 06/0	858010
		Benzene	LT 3 -01		B\$R010
		Carbon Tetrachloride	11 3 -01	0/0/0	658010
			7		888020
		Methylene Chloride	_		RAROSO O
					247777

Sample		Sciemary of Anglytical Re	ol Results	Tesk 10 senitery Severs	6 2 1	11 Yerd	Admini	Reil Yerd & Administration
9.5-10.5 Soil Hexachlorocyclopentadiene	Boring		Sample		Res	ults	Units	Sample Number
Childropherylmethyl Sulforde	1003000R30	9.5-10.5	Sofi	Hexachlorocyclopentadiene			0/00	85V002
Chromium							0/07	BSV002
Chromium Chromopane Chromium Chromopane Chromopane Chromopane Chromopane Chromium Chromium Chromopane Chromium Chro							0/00	BSV002
Chromium Copper							0/00	830002
Disconce							0/01	555020
Disconcentence							0/00	B35020
Disoprepartialism				Dithrogoch oropropane			0/07	B\$V002
Dispense Use Dispense Use Distribution				Dickelopentadiene			0/80	880002
Disapproprimethy! Phosphonate LT 8 -01 ug/g Distinant Distinant Distinant Distinant Endrin Hercury Isodial bouty! Ketome LT 5 -01 ug/g LT 5 -01 ug/g Herby! isobuty! Ketome LT 5 -01 ug/g Herby! isobuty! Ketome LT 5 -01 ug/g Herby! isobuty! Ketome LT 5 -01 ug/g LT 5 -01 ug/g LT 5 -01 ug/g LT 6 -01 ug/g LT 6 -01 ug/g LT 6 -01 ug/g LT 7 9 -01 ug/g LT 9 -01 ug/g LT 9 -01 ug/g LT 9 -01 ug/g LT 3 -01 ug/g LT 1 3 -01 ug/g LT 1 3 -01 ug/g LT 2 5 -00 ug/g				Vapona			0/00	B\$V002
Dithiane Dislatin Dislatin Dislatin Dislatin Dislatin Dislatin Dislatin Dislatin Endrin Herbyldisulfide LT 6 -01 ug/g Hercury Isodrin Hethylisabutyl Ketone LT 5 -02 ug/g Herbylisabutyl Ketone LT 3 -01 ug/g Helbylisabutyl Ketone LT 4 -01 ug/g LT 6 -01 ug/g LT 6 -01 ug/g LT 6 -01 ug/g LT 6 -01 ug/g Dichlorodiphenylethane Dichlorodiphenylethane LT 6 -01 ug/g Dichlorodiphenylethane LT 6 -01 ug/g Dichlorodiphenylethane LT 3 -01 ug/g Vinyldiethyl Phosphates LT 3 -01 ug/g Vinyldiethyl Phosphates LT 3 -01 ug/g Zinc Ansenic LT 3 -01 ug/g LT 5 -00 ug/g				e tagged () the tagg			0/011	83V002
Dieldrin Dimethyldisulfide Dimethyldisulfide Endrin Hercury Isodrin Methyldisulfide LT 5.0 -02 ua/o Isodrin Methylisobutyl Ketone LT 5.0 -02 ua/o I,4-Oxathiane Lead Dichlorodiphenylethane LT 6 -01 ua/o Dichlorodiphenylethane LT 3 -01 ua/o Vinyldiethyl Phosphates LT 3 -01 ua/o Tetrachloroethene LT 3 -01 ua/o Inichloroethene LT 3 -01 ua/o Inichloroethene LT 3 -01 ua/o LT 5 +00 ua/o LT 5 +00 ua/o LT 5 +00 ua/o LT 2.5 +00 ua/o							0/07	BSV002
Mercury Mercury LT 5.0 -01 ug/g				275.450			0/07	850002
Hercury Hercury				Dimethyldisulfide			0/00	BSR010
Metroury Metron				Endrin			0/00	BSV002
Isodrin Methylisobutyl Ketone LT 3 -01 ug/g Methylisobutyl Ketone LT 3 -01 ug/g LT 4 -01 ug/g LT 6 -01 ug/g LT 6 -01 ug/g LT 6 -01 ug/g LT 6 -01 ug/g LT 7 9 -01 ug/g LT 8 -01 ug/g LT 9 -01 ug/g LT 1 3 -01 ug/g LT 2.5 +00 ug/g LT 2.5 +00 ug/g LT 2.5 +00 ug/g LT 2.5 +00 ug/g LT 3 -01 ug/g LT 2.5 +00 ug/g							0/00	891008
Methylisobutyl Ketone Methylisobutyl Ketone Lided Load L				Teodrita			0/07	B\$V002
Lead Lead Dichlorodiphenylethane LT 6.3 +00 ua/g Dichlorodiphenyltrichloro- Ethane Perethion 2-Chloro-1(2,4-Dichlorophenyl) Vinyldiethyl Phosphates Tetrachloroethene Trichloroethene Z-Ch Aldrin LT 301 ua/g LT 301 ua/g LT 301 ua/g LT 301 ua/g LT 2.5 +00 ua/g LT 301 ua/g LT 2.5 +00 ua/g LT 301 ua/g LT 2.5 +00 ua/g LT 2.5 +00 ua/g LT 2.5 +00 ua/g LT 2.5 +00 ua/g				Mark 1			0/01	CION N
Lead Lead Location of the properties of the post of				Marie Landon Landon Landon Marie Landon Land			0/01	S COUNTY SE
Lead Dichlorodiphenylethane LT 9 -01 ua/9 Dichlorodiphenyltrichloro- LT 3 -01 ua/9 ethane Perethion 2-Chloro-1(2,4-Dichlorophenyl) LT 3 -01 ua/9 Vinyldiethyl Phosphates LT 3 -01 ua/9 Tetrachloroethene LT 3 -01 ua/9 Trichloroethene LT 3 -01 ua/9 Trichloroethene LT 3 -01 ua/9 LT 2.5 +00 ua/9 LT 3 -01 ua/9 LT 2.5 +00 ua/9 LT 2.5 +00 ua/9 LT 3 -01 ua/9 LT 3 -01 ua/9 Zinc Ansenic				1,4-0xathiane			0/00	B\$V002
Dichlorodiphenylethane LT 9 -01 ug/g ethane ethane Parathion 2-Chloro-1(2,4-Dichlorophenyl) Vinyldiethyl Phosphates Tetrachloroethene Thiodiglycol Trichloroethene LT 3 -01 ug/g LT 3 -01 ug/g LT 3 -01 ug/g LT 2.5 +00 ug/g LT 3 -01 ug/g LT 2.5 +00 ug/g				1			0,0	
Dichlorodiphenyltrichloro- ethene Parathion 2-Chloro-1(2,4-Dichlorophenyl) LT 3 -01 ug/g yinyldiethyl Phosphates LT 3 -01 ug/g Tetrachloroethene LT 3 -01 ug/g Thiodiglycol Trichloroethene LT 3 -01 ug/g Zinc Zinc LT 3 -01 ug/g LT 3 -01 ug/g LT 3 -01 ug/g Zinc LT 3 -01 ug/g Zinc LT 5.5 +00 ug/g Zinc LT 3 -01 ug/g Zinc				Lead Dichlorodiobenylethane			0 0	85V002
ethane Parathion 2-Chloro-1(2,4-Dichlorophenyl) LT 3 -01 ug/g Vinyldiethyl Phosphates LT 3 -01 ug/g Tetrachloroethene LT 2.5 +00 ug/g Trichloroethene LT 3 -01 ug/g Zinc Zinc Aldrin Aldrin LT 3 -01 ug/g 2.3 +01 ug/g 2.5 +00 ug/g 4.7 Soil Aldrin				Dichlorodiphenyltrichloro-			0/00	65V002
Perethion 2-Chloro-1(2,4-Dichlorophenyl) LT 3 -01 ug/g Vinyldiethyl Phosphates LT 3 -01 ug/g Tetrachloroethene LT 2.5 +00 ug/g Trichloroethene LT 3 -01 ug/g Trichloroethene LT 3 -01 ug/g Zinc Zinc Aldrin Aldrin LT 3 -01 ug/g LT 3 -01 ug/g LT 5.5 +00 ug/g LT 2.5 +00 ug/g LT 3 -01 ug/g LT 3 -01 ug/g Zinc Arsenic				ethane			i	
2-Chloro-1(2,4-Dichlorophenyl) LT 3 -01 ug/g Vinyldiethyl Phosphates Intrachloroethene LT 3 -01 ug/g Thiodiglycol LT 2.5 +00 ug/g Trichloroethene LT 3 -01 ug/g Zinc Zinc Zinc Zinc Aldrin Aldrin LT 3 -01 ug/g Arsenic LT 3 -01 ug/g				Parathion			0/05	890002
Tetrachloroethene LT 3 -01 ug/g Thiodiglycol LT 2.5 +00 ug/g Trichloroethene LT 3 -01 ug/g Zinc 2.3 +01 ug/g 4.7 Soil Aldrin LT 3 -01 ug/g Arsenic LT 2.5 +00 ug/g				2-Chloro-1(2,4-Dichlorophenyl) Vinyldiethyl Phosphates			0/00	880002
Tetrachloroethene LT 3 -01 u0/9 Thiodiglycol LT 2.5 +00 u0/0 Trichloroethene LT 3 -01 u0/9 Zinc 2.3 +01 u0/9 Ansenic LT 3 -01 u0/9							•	
Thiodigiyeol LT 2.5 +00 ue/g Trichloroethene LT 3 -01 ue/g Zinc 2.3 +01 ue/g 4.7 Soil Aidrin LT 3 -01 ue/g Arsenic LT 2.5 +00 ue/g				Tetrachloroethene			0/00	BSR01 0
				Thiodigiyeol			0 / 0	25A017
4.7 Soil Aldrin LT 3 -01 ue/o e/o e/o e/o				richionoethene 24pc			0/00	010X68
4.7 Soil Aidrin LT 3 -01 ue/o Arsenic LT 2.5 +00 ue/o				21115				03000
LT 2.5 +00 ug/g	35000050	4.7	5011	Aldrin			0/00	8XH006
				Arsenio			0/00	8x0016

5 1	5 1	5 1		7 44444 44444 44444							111 12 12 12 13 13 13 13		# 00000 00000 00000 0000 0 0			
	. 22222 2222 2															
n n n n n n n n n n n n n n n n n n n	n 10 10 40 10	n n n n	3	2	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0			3								
ר יייי דיייי אייי אייי איייי איייי																
Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfoxide p-Chlorophenylmethyl Sulfore Chromium Copper Dibromochloropropene			0	Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfore p-Chlorophenylmethyl Sulfore chromium Copper Dibromochloropropane Dibromochloropropane Discomochloropropane Discolopentadiene Vapona Diftxopropylmethyl Phosphonate Dithiane	Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfore chromium Copper Chromochloropropane Dibromochloropropane Distromochloropropane Distromochloropropane Distromochloropropane Distromochloropropane Distromochloropropane Distrimane	Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfore b-Chlorophenylmethyl Sulfore Chromium Copper Chromochloropropane Dibromochloropropane Dibromochloropropane Discolopentadiene Vapona Discolopentadiene Vapona Discolopentadiene Colopentadiene Colopentadiene Colopentadiene Colopentadiene Discolopentadiene Discolopentadiene Discolopentadiene	Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfone chromium Copper Chromochloropropane Dibromochloropropane Distromochloropropane Distromochloropropane Distromochloropropane Distromochloropropane Distrimethyl Phosphonate Dithiane Celdrin Endrin	Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfone p-Chlorophenylmethyl Sulfone chromium Copper Dibromochloropropane Dibromochloropropane Discoplopentadiene Vapona Discoplopylmethyl Phosphonate Dithiane Dithiane Dithiane Mercury Isodrin Malathion	Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfone chromium Copper Chromicum Copper Dibromochloropropane Dibromochloropropane Discolopentadiene Vapona Discolopentadiene Vapona Ditsopropylmethyl Phosphonate Dithiane Dithiane Isodrin Malathion 1,4-Oxathiane	dene lorophenylmethyl Sulfide lorophenylmethyl Sulfone lorophenylmethyl Sulfone lorophenylmethyl Sulfone low str mium spr mochloropropane spropylmethyl Phosphonate lane lane lane larin in systemiane Sxathiane	Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfore p-Chlorophenylmethyl Sulfore chromium Copper Chromium Copper Dibromochloropropane Discorlopentadiene Vapona Offsopropylmethyl Phosphonate Ditclorin Endrin Hercury Isodrin Malathion I.4-Oxathiane Lead Dichlorodibhenylethane Dichlorodibhenyltrichloro-	Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfone b-Chlorophenylmethyl Sulfone Chromium Copper Chromochloropropane Dibromochloropropane Dibromochloropropane Oicyclopentadiene Vapona Oitsopropylmethyl Phosphonate Dithiane Dithiane 1.4-Oxathiane 1.4-Oxathiane Dichlorodibhenylethane Dichlorodibhenyltrichloro- ethane Perathion	Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfone b-Chlorophenylmethyl Sulfone Chromium Copper Dibromochloropropane Dibromochloropropane Discolopentadiene Vapona Dityclopentadiene Vapona Dityclopentadiene Ditylane Ditylane Dithlane Dithlane Isodrin Malathion I.4-Oxathiane Dichlorodibhenylethane Dichlorodibhenylethane Perathion 2-Chloro-I(2,4-Dichlorophenyl) Vinyldiethyl Phosphates	ne ophenylmethyl Sulfide ophenylmethyl Sulfone m chloropropane chloropropane pentadiene opylmethyl Phosphonate e n n n n n n n n n n n n n n n n n n	ne ophenylmethyl Sulfide ophenylmethyl Sulfoxide ophenylmethyl Sulfore m chloropropane chloropropane opylmethyl Phosphonate e thiane odibhenylethane odibhenyltrichloro- on triane richloroethane	Chlordene p-Chlorophenylmethyl Sulfide p-Chlorophenylmethyl Sulfone Chromium Copper Dibromochloropropane Dibromochloropropane Disclopentadiene Vapona Disspropylmethyl Phosphonate Ditsopropylmethyl Phosphonate Ditsopropylmethyl Phosphonate Ditsopropylmethyl Phosphonate Ditsopropylmethyl Phosphonate Ditsopropylmethyl Phosphonate Lead Dichlorodibhenylethane Dichlorodibhenylethane Dichlorodibhenyltrichloro- ethane Parathion 2-Chloro-1(2,4-Dichlorophenyl) Vinyldiethyl Phosphates Thiodialycol 2inc 1,1,1-Trichloroethane 1,1,2-Trichloroethane
Sulfoxide Sulfone	Sulforide Sulfone	Sulforide Sulfone	•	•	•	•	•	•	•	•	•	•	•	•	•	•
#50 100															•	
ochloropropane LT	ochloropropane LT	ochloropropane LT ochloropropane LT opentadiene LT	ללל ל	ננננ נ	ל לללל ל	לל לללל ל	ב בר ברבר ב	בל כל בלבל ב	ל לל לל לללל ל	י ל לל לל לללל ל	לל ל לל לל לללל ל	ל לל ל לל לל לללל ל	t	t	5 555 55 55 5 5 5 5 5 5 5 5 5 5 5 5 5	ינב ב בב בב בב בבב ב
		1	L L L L L L L L L L L L L L L L L L L	רורני	ל לללל	בל לללל	ב בב בבבב	כל כל ללכל	ל לל לל לללל	ב בב בב בבבב	מל ל לל לל לל	ל כל ל כל כל בלכל	5555 55 55 5 5 5 5 5 5 5	ל ל לל ל לל לל לל	ב ב ב ב ב ב ב ב ב ב	מל ל ל ל ל ל לל לל לל לל

Ebasco Serv	Ebasco Services Incorporated	ated	Rocky Mountain Ara-nal Program	Arsenal Pro	Gram				08/01/88	
Summery of	Summery of Analytical Results	sults	Tesk 10 Ser	Sanitar∕ Sewers Rail Yard & Administration	<u> </u>	111 Y	ard &	Admini	tration	
Boring Number	Depth (ft)	Sample Type	Analytical Parameters		8	Results		Units	Sample Number	i
1035000064	4.1-5.1	5011	1,2-Dichloroethane m-Xylene Aldrin Arsenic Atrazine		ררייי		100 00 00 00 00 00 00 00 00 00 00 00 00	00000	8UGD02 8UGD02 8UHD02 8TY011 8UHD02	
			Bicycloheptadiene Benzene Carbon Tetrachloride Cedmium Methylene Chloride			*****	1010100	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	8U6002 8U6002 8U6002 8TX007 BU6002	
			Chloroform Hexachlorocyclopentadiene Chlorobenzene Chlordane p-Chlorophenylmethyl Sulf	liene Sulfide	ַבְּבְּבְבָּבְבָּבְ	n 0 = 0 0	100010	99999	80/6002 80/4002 80/6002 80/4002	
			p-Chlorophenylmethyl (b-Chlorophenylmethyl (chromium Copper Dibromochloropropane	Sulfoxíde Sulfone	לל לל	88.448 8.40	10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	00000	8UH002 8UH002 8TX007 8TX007 8UH002	
			Dibromochloropropane Dicyclopentadiene Dicyclopentadiene Vapona Diisopropylmethyl Phosphonate	phonete	ווייי	0 C = 0 =	00000	00000	8UGD02 8UGD02 8UHD02 8UHD02 8UHD02	
			Dithiane Dieldrin Dimethyldisulfide Endrin Ethylbenzene		ווווו	450004	-01 -01 -01	00000	BUHOO2 BUHOO2 BUHOO2 BUGOO2	
			Mercury Isodrin Toluene Methylisobutyl Ketone		1111	0.00 K	-02 -01 -01	0/000	872011 BUMOD2 BUGOD2 BUGOD2	

Note: Results for some parameters may appear in more than one analytical fraction.

Ebasco Serv	Ebasco Services Incorporated	ated	Rocky Mountain Arsenal Program	.oooo.			08/01/88
SUBBERTY of	Summary of Analytical Results	sults	Tesk 10 Senitery Secens	s Reil Yard		* Admini	& Administration
Boring	Depth (ft)	Sample	Analytical Parameters	Results		Units	Semple Number
1035000064	4.1-5.1	Soft	Melethion		-01	0/00	BUHD02
			1,4-Oxathiene	m		0/00	BUH002
						0/00	6TX007
			Dichlorodiphenylethene Dichlorodiphenyltrichloro	ه ه د د	គុតុ	0/07	
			ethene		3		
			Perethion	11 9	-01	0/00	BUH002
			2-Chloro-1(2,4-Dichlorophenyl)	LT 6	٠ <u></u>	0/00	BUH002
			Vinyidiethyl Phosphates		i	•	
			Tetrachloroethere	ה ה	5 6	0/07	500002 500002
			Trich proethers			0 0	Sur DOZ
							10000
			Ortho- & Pers-Xylene	LT 5		0/00	BUG002
			Zinc	2.6	101	0/00	81X007
10.35000064	8.1-9.1	Sofi	1,1,1-Trichloroethane	7	10-	0/00	BUG003
			1,1,2-Trichloroethane		ö	0/00	BUGOO3
			1,1-Dichloroethane	LT 2	0	0/00	BUGGGS
			1,2-Dichloroethene		ę	0/00	B U6003
			1,2-Dichloroethane	۱٦ ه	-01	0/00	B UG003
			3-X-10-10		-01	0/00	BU9003
			Aldrin	L1 3		0/00	BUHDOS
			Arsenic	3.6		0/00	BTY012
			Atrazine		1 0-	0/00	BUHOO3
			Bicycloheptadiene	LT 6	-01	0/00	800003
			867265		-01	0/00	BU6003
			Carbon Tetrachloride	LT 3		0/00	800003
			Codmium	LT 7.3		0/00	81X008
			Methylene Chloride	LT 2	-	0/00	800003
			Chloroform		-01	0/00	BUG003
			Hexachlorocyclopentadiene	LT 6	-01	0/00	BUHOO3
			Chlorobenzene		00+	0/00	Buccos
					00+	0/00	BUHOO3
				6 • - 1	Ģ 6	0/00	BUH003
			p-chiorophenyimethyi suitoxide		1 0-	0 /00	200400

Summery of Anglytical		Results	Task 10 Senitery Severs			Ö	Reil Yerd & Administration	
Boring	Depth (ft)	Sample	Anglytical Parameters	ě	Reaults		Units	Sample Number
103500064	8.1-9.1	5011	p-Chlorophenylmethyl Sulfone Chromium Copper Dibromochloropropme	5 5	2 2	2 401	0000	BU4003 BTX008 BTX008 BU6003
			Dibromochloropane	בֿינ	1 10	- 10-	0/00	BUHDOS
			Dicyclopentadiene	ב	^	-01	0/00	BUGOOS
			Dicyclopentadiene Venome		M	0 0	0/07	BUH003
			Discorporate Phosphonate Distribute	:55	- 4	0 0	0/00	BUHDO3
					•	ä		
					0 0	7 7	0 0	BUG003
				- 1	en	Õ	0/00	BUH003
			Ethylbenzene	- 1	4	Ģ	0/00	BUGGGS
			Isodrin	L.1	m	-01	0/30	BUHDOS
			Toluene	۲,	* 7	-01	0/00	BUG003
			Methylisobutyl Ketone	7	^	-01	0/00	B UGD03
			Malathion	ר	٨	-01	0/00	BUHDDS
			1.4-0xathiane	ר		-01	0/00	BUHDD3
			Peed	ב	œ.	3 +00	0/00	BTXDOB
			Dichlorodiphenylethene	7	٠	-01	0/00	BUHDDS
			Dichlorodiphenyltrichloro-	LT	s٥	-01	0/00	BUHDDS
			ethore	-	o	č	6/6:	1000
			Parachions 1(2 4-Dichionophens)	<u> </u>	•	ָּהְלָּהְלָּהְ	0/07	BC#4003
			Viryldiethyl Phosphates	5	•	5		
			Tetrachloroethene	LT	₽)	-01	0/00	BU6003
			Thiodiglycol	11	2.5	00+	0/00	88F003
			Trichloroethene	11	ĸ	٥-	0/00	BUG003
			Ortho- & Para-Xylene	ר	'n	9	0/00	800003
			Z1nc		4	3 +01	0/00	BTXOOS
1035000065	4.	5011	Aldrin	-1	*)	101	0/00	BXH005
			Arsenic		8	9 +00	0/00	BXD015
				•	•		- ,	************

Note: Results for some parameters may appear in more than one analytical fraction.

Summary of Analytica	-	Results	Task 10 Seniter	Spoitory Severs Roll Yand & Adainistration	ž	ž T	P D	Admini	stration
Boring	Depth (ft)	Sample	Anmivtical Parameters		٥	Results	} !	Units	Sample Number
1035000065	4.6	Soil	Codmitum		١,	٧.٧	-01	0/00	8×1008
			Mexachlorocyclopentadiene		ר		-01	0/00	BXHOOS
			Chloroscetic Acid			?	101	0/0 0/0	BXEOOS
			Chlordane p-Chlorophenylmethyl Sulfide	•b	ב ב	N 0	5 6 6	0 0	BXHOUS BXHOUS
				Sul fox ide	-	,	-01	0/00	8XH005
			p-Chlorophenylmethyl Sulfone	one	ב		-01	0/00	BXH005
			Chromium				1 0+	0/07	8×1008
			Copper			n	101	0/00	8×1008
			Dibromochloropropane		_	* ?	٠	0/00	3XH005
			Of browner) or opens			7.2	-03	0/00	BXF008
			Dicyclopentadiene		ב		80+	0/00	BXHOOS
			Vapone		11	m	00+	0/00	BXHO05
			Diisopropylmethyl Phosphonate	nate	ב	-	00+	0/00	BXH005
			Dithiane		ב	4	-01	0/00	BXH005
			0.00100		-	P)	-01	0/00	8XH005
			Endrin		-		-01	0/07	BXH005
			Mercury			F. 3	80+	0/00	8×6007
			Isodrin		-		-01	0/00	BXH005
			Melethion		-		٠٥٠	0/00	BXH005
			1.6-0xsthisne		-	* 2	-01	0/07	SXHOOS
						۲.	10+	0/00	8×1008
			Dichlorodiphenylethene		ב		-01	0/07	8XHO05
			Dichlorodiphenyltrichloro-		1	S.	-01	0/00	BXHOOS
			ethane						
			Perethion		-	o	-01	0/00	8XHOOS
			2-Chloro-1(2,4-Dichlorophenyi)	eny 1)	ב	•	-01	0/00	BXHOOS
			Vinyldiethyl Phosphates		,		6	,	
			Thiodigiycol		-		00;	0 (0	SXE DOS
			Zinc			o •>	10	0/00	8×1008
1034150001	0-1	5011	Aldrin		-		-01	0/00	CEPOOS
			Arsento		_	6	00+	0/00	CENOSO
			Atrezine		ļ		-01	0/00	CEPUOS

Ebasco Serv	Ebasco Services Incorporated	eted	Rocky Mountain Arsenal Program	rogram				08/01/88
Summery of	Summery of Analytical Re	Results	Task 10 Sanitary Severs		7611	Yerd	Admini	Rail Yard & Administration
Boring Number	Depth (ft)	Sample	Analytical Perameters	قد ا	Results	•	Unita	Sample Number
1034150001	0-1	5011	Hexachlorocyclopentadiene Chloroacetic Acid Chloroacet b-Chlorophenylmethyl Sulfide b-Chlorophenylmethyl Sulfide	נננננ	νω <u>+ φ. α</u> . ν	-01 -01 -01 -01	00000	CE POOB CE X009 CE POOB CE POOB
			p-Chlorophenylmethyl Sulfone Chromium Copper Dibromochloropropene Dicyclopentadiene	מל ל	2. 41. 41. 42. 76. 76. 76. 76. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	-01 6 1 -01 +00	00000	CE PODS CE YOO7 CE YOO7 CE PODS CE PODS
			Vapona Diisopropylmethyl Phosphonate Dithiane Dieldrin ndrin		w w 4	+00 +00 -01 -01	00/000	CEP008 CEP008 CEP008 CEP008
			Mercury Jaodrin Malathion 1,4-Oxathiane Lead	בבב	4.1 2.7. 3.76	6 - 01	00000	CEP008 CEP008 CEP008 CEP008
			Dichlorodiphenylethane Dichlorodiphenyltrichloro- ethane Parathion 2-Chloro-1(2,4-Dichlorophenyl) Vinyldlethyl Phosphates Thiodiglycol	נו נון	0.4 6 0 4	-01 -01 -01 -01	00 00 0	CEP008 CEP008 CEP008 CEP008
10341.50001	4 - t _r	5011	Zinc 1,1,1-Trichloroethane 1,1,2-Trichloroethane 1,1-Dichloroethane 1,2-Dichloroethane 1,2-Dichloroethane		10 10 10 10 10 10 10 10 10 10 10 10 10 10	601 -01 -01 -01	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	CEM008 CEM008 CEM008 CEM008 CEM008 CEM008

Sample S	Ebasco Serv	Ebasco Services Incorporated	ated	Rocky Mountain Arsenal Program	senal Prog	60				08/01/88	/88
Sample	Summery of	Anolytical Re	99-11 t.s		ry Sewers	1	1 1 6	Yerd	Admini	stration	
4-5 5011 m.Xylene Aidrin Araenic Barzene Carbon Tetrachloride Cadmium Heikylene Chioroperate Chioroperat	Borfro	Depth (ft)	Sample	Analytical Parameters		8	sult.	,	Units	Semple Number	
17 201 1 19/9 1 1 2 1 1 1 2 1 1 1 1 2 1 1 1 1 1 1 1	10341.50001	88	5011	m-Xylene		1	^	-01	0/00	CEMOOB	
17 2.5 +00 18 3 -01 19 4 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6				Aldrin		בן	6	10-	ø/øn	CEP009	
17 3 -01 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				Arsenio			, c		0/07	CEU021	
tr 3 -01 ug/g tr 7 -01 ug/g tr 7 -01 ug/g tr 3 -01 ug/g tr 4 -01 ug/g tr 5 -01 ug/g tr 5 -01 ug/g tr 5 -01 ug/g tr 7 -01 ug/g tr 8 -01 ug/g tr 8 -01 ug/g tr 8 -01 ug/g tr 9 -01 ug/g tr 1 -00 ug/g tr 2 -01 ug/g tr 3 -01 ug/g tr 3 -01 ug/g tr 3 -01 ug/g tr 5 -01 ug/g				Bicycloheptadiene		: 5	i m	-0.	0/00	CEMOOB	
ove transfer to the control of the c				Benzene		1	100	-01	9/8	CEMOOB	
oxide				Carbon Tetrachloride		ב	m	-01	D/0n	CEMOOS	
oxide				Cadelus		5	7.4	0 -1	0/00	CEYOOB	
ide				Methylene Chloride		<u>ا</u> ا	~ '	1 0	0/00	CEMOOB	
ide				Chloroform		_	m	-01	0/00	CEMOOS	
Sulfade LT 3.5 +01 ug/g LT 3 -01 ug/g LT 1 -00 ug/g Sulfone LT 201 ug/g 1.30 1 ug/g 1.50 0 ug/g LT 201 ug/g LT 301 ug/g LT 3. +00 ug/g LT 3. +00 ug/g LT 3. +00 ug/g LT 301 ug/g LT 301 ug/g LT 301 ug/g LT 301 ug/g LT 501 ug/g				Hexachlorocyclobentadiene		-	'n.		0/00	CEP009	
Sulfide LT 301 ug/g Sulfoxide LT 201 ug/g Sulfone LT 201 ug/g 1.30 1 ug/g 1.30 1 ug/g 1.7 401 ug/g 1.7 3. +00 ug/g 1.7 3. +00 ug/g 1.7 301 ug/g 1.7 301 ug/g 1.7 301 ug/g 1.7 501 ug/g				Chloroscetic Acid		11	ъ. В		0/00	CEX010	
Sulfide LT 201 ug/g Sulfoxide LT 201 ug/g Sulfone LT 201 ug/g 1.30 1 ug/g LT 201 ug/g LT 301 ug/g LT 3. +00 ug/g LT 3. +00 ug/g LT 301 ug/g LT 501 ug/g				Chlorobenzene		5!	n,	10	0/00	CEMOOS	
Sulfide Sulfoxide LT 201 ug/g Sulfone LT 201 ug/g 1.30 1 ug/g 1.50 0 ug/g LT 201 ug/g LT 301 ug/g LT 201 ug/g LT 301 ug/g				Chlordene		ٔ د	;	3	0/0	CEFOUS	
Sulforde LT 201 ug/g Sulfone LT 201 ug/g 1.30 1 ug/g LT 4 -01 ug/g LT 3 -01 ug/g LT 5 -01 ug/g				p-Chlorophenylmethyl Sulfi	10e	ב	œ.	-01	0/0n	CEP009	
Sulfone LT 201 ug/g 1.30 1 ug/g 1.30 1 ug/g 1.30 1 ug/g 1.30 1 ug/g 1.7 201 ug/g 1.7 301 ug/g 1.7 301 ug/g 1.7 301 ug/g 1.7 501 ug/g					oxide	7	2	-01	0/00	CEP009	
1.30 1 ug/g 9.69 0 ug/g LT 4 -01 ug/g LT 3 -01 ug/g LT 11 +00 ug/g LT 3 -01 ug/g LT 2 -01 ug/g LT 2 -01 ug/g LT 4 -01 ug/g LT 5 0 -02 ug/g					one	ר	۶.	-01	0/00	CEP009	
9.69 0 ug/e LT 201 ug/e LT 3 -01 ug/e LT 301 ug/e LT 3. +00 ug/e LT 3. +00 ug/e LT 201 ug/e LT 201 ug/e LT 201 ug/e LT 201 ug/e LT 301 ug/e LT 5.0 -02 ug/e				Chromium			1.3		0/00	CEYOOS	
LT 201 ug/g LT 301 ug/g LT 1. +00 ug/g LT 3. +00 ug/g LT 3. +00 ug/g LT 201 ug/g LT 201 ug/g LT 201 ug/g LT 201 ug/g LT 301 ug/g LT 301 ug/g LT 301 ug/g LT 301 ug/g LT 301 ug/g LT 301 ug/g				Copper			9.6		0/00	CEYDOS	
LT 201 ug/g LT 3 -01 ug/g LT 1. +00 ug/g LT 3. +00 ug/g LT 301 ug/g LT 201 ug/g LT 401 ug/g LT 5. 0 -02 ug/g				Dibromochloropropane		5	4	-01	0/00	CEMOOS	
1 3 -01				Dibromochloropropane		-	6	-01	0/00	CEP009	
Phosphonate LT 1. +00 ug/g LT 3. +00 ug/g LT 2. +01 ug/g LT 201 ug/g LT 801 ug/g LT 801 ug/g LT 801 ug/g LT 5. 0 -02 ug/g LT 5. 0 -02 ug/g LT 5. 0 -02 ug/g LT 5. 0 -01 ug/g LT 5. 0 -02 ug/g LT 5. 0 -01 ug/g LT 5. 0 -01 ug/g LT 501 ug/g LT 501 ug/g LT 501 ug/g				Dicyclopentadiene		L.1	m	-01	0/00	CEMOOS	
Phosphonate LT 3. +00 ug/g LT 301 ug/g LT 201 ug/g LT 401 ug/g LT 3 -01 ug/g LT 5.0 -02 ug/g LT 5.0 -02 ug/g LT 5.0 -02 ug/g LT 5.0 -02 ug/g LT 5.0 -01 ug/g				Dicyclobentadiene		ב	.	00+	0/07	CEP009	
LT 301 UG/G LT 201 UG/G LT 401 UG/G LT 501 UG/G LT 501 UG/G LT 501 UG/G LT 201 UG/G LT 3 -01 UG/G LT 3 -01 UG/G LT 3 -01 UG/G				Vapona Diisopropylmethyl Phosphor	nate	ב ב	₩. .	8 8	0/00	CEP009	
LT 201 ug/g LT 8 -01 ug/g LT 401 ug/g LT 3 -01 ug/g LT 201 ug/g LT 201 ug/g LT 3 -01 ug/g tone				01 th 1000		-	'n	-01	0/00	CEP009	
LT 8 -01 UG/G LT 401 UG/G LT 3 -01 UG/G LT 201 UG/G LT 3 -01 UG/G tone LT 3 -01 UG/G				Dieldrin		1	'n	-0	0/00	CEP009	
nzene				Ofmethyldisulfide		11	€0	-01	0/00	CEMOOB	
nzene LT 3 -01 ug/g LT 5.0 -02 ug/g LT 201 ug/g LT 3 -01 ug/g sobutyl Ketone LT 3 -01 ug/g				Endrin		-		-01	0/00	CEP009	
17 5.0 -02 ug/g LT 201 ug/g LT 3 -01 ug/g sobutyl Ketone LT 3 -01 ug/g				Ethylbenzene		-	m	-01	0/00	CEMOOB	
LT 201 ug/g LT 3 -01 ug/g sobutyl Ketone LT 5 -01 ug/g				Zeroury		1	5.0		0/00	CE5014	
LT 3 -01 ug/g				Isodrin		-	6		0/00	CEP009	
LT 3 -01 ug/g				Toluene		L	۳)	-01	0/00	CEMOOB	
				Methyllsobutyl Ketone		٦	m	-01	0/00	CEMOOR	

Note: Results for some parameters may appear in more than one analytical fraction.

The second of th

Ebasco Services Inc	ices Incorporated	ated	Rocky Mountain Arsenal Program	TOGICAR			08/01/88	
Summery of Analytic	Analytical Re	al Results	Tesk 10 Senitery Severs		Reil Yard &	& Admini	Administration	
Boring Number	Depth (ft)	Sample Type	Analytical Parameters	8	Results	Units	Sample	ı
10341 50001	S-7	Sofi	Melethion	5.		0/00	CEPDO9	
			1,4-Uxathiane Lead	ב נ	8.40 0	0 0	CEYDOS	
			Dichlorodiphenylethane	-			CEP009	
			Dichlorodiphenyltrichloro- ethane	ר	401	0/00	CEP009	
			Parathion	1	801	0/00	CEP009	
			2-Chloro-1(2,4-Dichlorophenyl)	1	601	0/00	CEP009	
			Vinyldiethyl Phosphates Tetrachloroethene	-	3-01	0/00	CEMDOS	
			Thiodigiyeol	ר ו	4.2 +00		CEX010	
			Trichloroethene	-			CEMDOS	
			Ortho- & Para-Xylene	ני	3 -01	0/00	CEMOOB	
			Z1nc		4.83 1	0/60	CEYDOS	
1034150002	0-1	Soil	Aldrin	1,	3 -01	0/00	CFK005	
			Arsenic	7		0/00	CFD016	
			Atrazine	<u>-</u>		0/00	CFK005	
			Codmium	_	.40	0/00	CEYO2O	
			Mexachlorocyclopentadiene	_	3 -01	0/00	CFK005	
			Chloroacetic Acid	1	3.5 +01	0/00	CFM019	
				-1		_	CFK005	
				_			CFK005	
				<u>-</u> !	2 +00	0/00	CFK005	
			p-Chlorophenyimethyl Sulfone	-	-01	0/07	CFKOOS	
			Chromium		1.69 1	6/6n	CEY020	
			Copper		5.69 1	0/00	CE Y 020	
			Dibromochloropropane	-1		0/00	CFK005	
			Dicyclopentadiene	۲,	4 -01	0/00	CFK005	
			Vapona	-1	3 -01	0/80	CFK005	
			Diisopropylmethyl Phosphonate	LT	3 -01	0/00	CFK005	
			Dithiane	-		0/00	CFK005	
			Dieldrin	_		0/00	CFKOOS	
			Endrin	-1	3 -01	0/00	CFKOOS	
					-		6.704.5	

Note: Results for some parameters may appear in more than one analytical fraction.

Ebasco Serv	Ebasco Services Incorporated	ated	Rocky Mountain Arsens! Program	Program				08/01/88
Summery of Analytical		Results	Tesk 10 Seritery Severs	E 11 41 L		Yard &	Admini	Reil Yard & Administration
Boring	Depth (ft)	Semple	Anglyticel Peremeters	& G	Results		Units	Sample Number
1034150002	0-1	5011	Isopropylmethyl Phosphonic	רז	.	9	0/00	CFF005
			Acid	נ	m	Ģ	0/00	CFK005
			Malathion	<u>.</u>	m)	-01	0/00	CFK005
			1,4-0xathiane Lead	נ	4.28	+ 00 8 1	0 0 0	CFK005 CEY020
			Dichlorodiphenylethane	5	P)	-01	0/00	CFK005
			Dichlorodiphenyltrichloro-	בו	٠	i o	0/00	CFK005
			ethere	-	,	č	4/4:	200
				<u>.</u> :	4 1	5		Crados
			2-Chloro-1(2,4-Dichlorophenyl) Vinyldiethyl Phosobates	<u>-</u>	r)	-01	0/00	CFK005
			Thiodiglycol	Ļ	4.2	Ş	0/00	CFM019
			Zinc		8.92	2	0/07	CEYO20
1034L S0002	4-5	Soll	1,1,1-Trichloroethane	1	4	-01	0/00	CF 8008
			1,1,2-Trichloroethane	-1		-01	0/00	CFB008
			1,1-Dichloroethane	-1	-:	00+	0/00	CFB008
			1,2-Dichloroethene	11		00	0/00	CF6008
			1,2-Dichloroethane	<u>-</u>	ĸ,	-01	0/00	CF BOOB
			B-Xylere	1	۲.	-01	0/00	CF B008
			Aldrin	-1	m	-01	0/00	CFK006
			Arsento	-1	'n.	00+	0/00	CFD017
			Atrezine	ר	n	-01	0/00	CFK006
			Bicycloheptadiene	ב	'n	-01	0/00	CF 8008
			Benzene	ב	~	-01	0/00	CF 8008
			Carbon Tetrachloride	11	۶.	-01	0/00	CF 5008
			Codmitum	11	7.3	-01	0/00	CFP020
			Methylene Chloride	1		00+	0/00	CF 8008
			Chloroform	11		-01	0/00	CF B 008
			Hexachlorocyclopentadiene	11	•3	-01	0/00	CFK006
			Chloroscetic Acid	LT	5. U		0/00	CFM020
			Chlorobenzene	1	-	00	0/00	CF8008
			Chlordane	L.1	¢	-0	0/00	CFK006
			p Chlorophenylmethyl Sulfide	-1	7	00+	0/00	CFK006

Note: Results for some parameters may appear in more than one analytical fraction.

To be 1. Control of the second of the second

Note: Results for some parameters may appear in more than one analytical fraction.

Ebasco Serv	Ebasco Services Incorporated	ated	Rocky Mountain Arseral Program Task in Askinistration	00100 m	\ \ -	2 0 4 7	08/01/88
TO YEAR OF	Analytical Re	s a ros		r L			istration
Boring Number	Depth (ft)	Sample	Anglytical Parameters	æ 8 e	Results	Units	Samp Le Number
1034150002	. 40	5011	p-Chlorophenylmethyl Sulfoxide	11	2 +00	0/00	CFK006
			p-Chlorophenylmethyl Sulfone	ר			CFK006
			Chromium				CFP020
			Copper Dibroschloropropere	<u>ן</u>	3 -01	9/97	CFK006
			Dibromochloropropane	ב נ	2. +00		CFBOOS
			Dicyclopentadiene				CFK006
			Dicyclopentadiene				CFBOOB
			Vapona	1	3 -01		CFK006
			Diisopropylmethyl Phosphonate	ב	3 -01		CFK006
			Dithiane		400	0/00/	CFK006
			Dieldrin	ב			CFK006
			Dimethyldisulfide		2. +01		CFB008
			Endrin		3 -01		CFK006
			Ethylbenzene		301	1 09/9	CF8008
			× Local Section 1	-	5.0 -02	2 1/9/9	CFR020
			[aconcov]methy] Phosphonic				CEROOF
			Actd				
			Isodrin		3 -01	1 00/0	CFK006
			Toluene	ני	201		CF8008
			Methyllsobutyl Ketone		701		CFB008
			Majeth Co	-	10-	0/00	CFKOOS
			1.4-Oxethiene	-			CFK006
			Lead		۳,		CFF020
			Dichlorodiphenylethane		3 -01		CFK006
			Dichlorodiphenyltrichloro-	ר	6 -01		CFK006
			ethane				
			Perethion		-01	0/00	CFK006
			2-Chloro-1(2,4-Dichlorophenyl)		3 -01		CFKOD6
			Vinyldiethyl Phosphates				
			Tetrachloroethene		201	1 00/0	CFB008
			Thiodigiycol		ď	0/0n C	CFM020
			Trichloroethene	<u></u>	501	0/6n 1	CF8008
			Ortho- & Para-XVlese	1	4. +00	0/00	CFB008
							1

08/01/88	stration	Sample Number	CF F020
	& Admini	Units	0/00
rogram	Sanitary Severs Rail Yard & Administration	Pesults	5.8 +01 ug/g
Rocky Mountain Arsenal Program	Task 10 Sanitary Seve	Analytical Parameters	Zinc
ited	ults	Sample	5011
ices Incorporated	Summery of Analytical Results	Sample Depth (ft) Type	S- 7
Ebasco Services	Summery of	Boring	1034150002

Note: Results for some parameters may appear in more than one analytical fraction.

C

C

Ebasco Services Incorporated

Sample Number	1			_	_	9 85R001	9 BSR001				G 65R001	9 65R001			_	g 85R001	9 BSR001			_	g BSR001	-	9 BSR001			g 85R001	9 855001	9 655001	_	_	9 655001	9 851001		_	9 BSU001
Unit:		0/00	B/85	0/05	0/00	0/05	9/00	0/80	0/00	0/00	0/05	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/00	0/0n	0 /00	9/90	0/00	8/80	0/05	0/00	0/00	0/07	0/07	0/00	0/07	0/00	0/0n	0/00	0/00
\$		-			ģ	10-	-01	-01	-01	-01	-01	-01	-01	٠ 1	٠	1 0-	-01	-01	-01	0	io-	1 0	-01	-01	ö	-01		9			10- 1	-01		-01	00+
Results		'n	2.5	2.5	'n	n	P)	n	^	P)	m)	4	n	•	n	r)	P)	m	#)	r)	o	n	r)	r)	Þ)	^	1.4	9.0	1.7	6.0	7.3	4.	m	P)	8
£			5	1	ר	ב	7	۲,	ר	L.1	-1	17	ב	1	-	ב	5	ר	11	ב	ב	רז	ב	1	-1	ב י					ני		L1	11	L-1
Analytical Parameters		Arsenic	Thiodigiycol	Thiodigized	Arsenic	Bicycloheptædiene	Carbon Tetrachloride	Chloroform	Methylene Chloride	Chlorobenzene	Benzene	Dibromoch!oropropene	Dicyclopentadiene	Dimethyldisulfide	Ethy Ibenzene	Toluene	Methylisobutyl Ketone	Tetrachloroethene	Trichloroethene	Ortho- & Pers-Xylene	1,1-Dichloroethane	1,1,1-Trichloroethane	1,1,2-Trichloroethane	1,2-Dichloroethene	1,2-Dichloroethane	a-Xylene	Chromium	Copper	Lead	21nc	Codmitum	Mercury	Aldrin	Atrezine	Chlordane
Type		6 lenk	61enk	51 Brit	. Glenk	G Lank	100 E	Blank	Blank	Blank	Blank	Blank	Blank	51ank	B1enk	03 1 th 7.5	Blank	Blenk	Blenk	61ank	Blenk	Blenk	B1 ank	81enk	B.i.enk	Blenk	Bienk	81 ank	81enk	Blenk	Blank	Blank	Blank	B) Brik	Blank

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Ebasco Services Incorporated

Summery of Analytical Results

Rocky Mountain Arsenal Program

Blanks Associated with Task 1D Sanitary Sewers -- Reil Yard & Administration

Type	Anslytical Peremeters	E	Results	it s	Unite	Semple Number
81erk	Hexachlorocyclopentadiene	1 5	۰	ļ ē	0/00	100089
81ank	p-Chloropherylmethyl Sulfide	-1	•	-01	0/90	880001
Blank	p-Chlorophenylmethyl Sulfoxide	5	m	-01	0/00	850001
Blenk		-	m	-01 10-	0/00	850001
Blank	Dibromochioropropane	ב	n	-01	0/00	650001
Blenk	Dicyclopentadiene	۲٦	-	00 +	0/00	850001
Blank	Verone	1	m	90	0/07	880001
Blank	Diisopropylmethyl Phosphonate	ב		9	0/00	8\$0001
Blank	Dithiane	ב	4	-01	0/00	880001
Blenk	Dieidrin	ב	n	-01	0/00	6 \$U001
Blank	Endrin	11	s n	-01	0/80	B\$ U001
B1 97K	Isodrin	11	m	-01	0/07	890001
61enk	Malethion	_	7	÷	0/00	850001
Blank	1,4-0xathiane		r)	101	0/00	880001
81enk	Dichlorodiphenylethene	7	¢	-01	0/00	6 50001
Blank	Dichlorodiphenyltrichloro-	L	ĸ	-01	0/00	890001
	ethene					
81ank	Parathion	1	•	-01	0/00	890001
Blank	2-Chloro-1(2,4-Dichlorophenyl)	ב	•	ō-	0/00	650001
	Vinyidiethy! Phosphates					
81enk	Aldrin	ב	ø	1 0-	0/00	BSV001
Blenk	Atrezine	L 1	m	90	8/80	BSV001
Blank	Chlordene	-	N	00+	0/00	850001
Blank	Hexachlorocyclopentadiene	1	*)	-01	9/60	830001
B) enk	p-Chlorophenylmethyl Sulfide	-	ĸ	٠ <u>-</u>	0/00	65V001
Blank	p-Chlorophenylmethyl Sulfoxide	-	•	-01	0/00	890001
Blank	p-Chlorophenylmethyl Sulfone	ב	^	-01	0/00	B\$V001
Blank	Dibromochloropropane	11	₽)	-01	0/00	850001
8) ank	Dicyclopentadiene	1		00+	0/00	850001
Blank	Vepone	1	ø	-01	0/00	BSV001
Blank	Diisopropylmethyl Phosphonate	-	60	-01	0/00	65V001
Rienk	Dithiane	-1	# 7	-01	0/00	BSV001

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Ebasco Services Incorporated Summary of Analytical Results

Rocky Mountain Arsenal Program

08/02/88

•

Blanks Associated with Tesk 10 Senitary Severs -- Reil Yard & Administration

- XDG						
1		<u>:</u>	,	Ş	8/81	100048
300		-	• •	3 5	8/07	
Y				1 6)	
¥	T BOOK T	ָ ֡ ֡	n -	5 1	3	100469
8187X	Malethion	֡֡֡֡	4	-01	0/00	B \$4001
81erk	1,4-Oxathiene	ב ב	0	-01	0/00	B \$V001
51enk	Dichlorodiphenylethane	11	•	-01	0/00	B\$V001
A) Ank	Dichlorodipheny) trichloro-	-	P 7	ָּהָ ק	0/07	880001
£	ethere	j)	5		
Blank	Parathion	<u>ر</u>	ø	-01	0/00	6\$1001
Blank	2-Chloro-1(2,4-Dichlorophenyl)	7	'n	-01	0/00	B SV001
	Vinyldiethyl Phosphates					
Blank Blank	Chromium		1.4	+01	0/00	61X001
8 Jenk	Copper		9.0	00+	0/00	81X001
Blank	Lend		1.1	+01	0/00	81 X001
Blenk	21nc		3.9		0/00	81 X001
Blank	Codefue		7.3	-01	0/00	81X001
8 Jank	Arsenic	-	2.5		0/00	BTY001
Blenk	Mercury		1.0	-01	0/00	812001
Blank	Bicycloheptadlene	ב	4	- 0-	0/00	806001
Blank	Carbon Tetrachloride	ב	m	-01	0/00	B U6001
Blenk	Methylene Chloride	-1	7	00+	0/00	B UG001
Blank	Chlorobenzene	ב	-	Q Q	8/8 0	800001
Blank	Benzene	11	ø)	-01	0/00	B U6001
81enk	Dithromochloropropane	-	~	9	0/00	806001
Blank	Dicyclopentadiene	-	^	-01	0/00	806001
Rienk	Dimethyldisulfide	1	8	10+	0/00	BUGDO1
81ank	Ethylbenzene	L1	4	-01	a/an	BUG001
81ank	Toluene	11	P)	-01	0/00	B UG001
Blank	Methylisobutyl Ketone	-	7	-01	0/00	6 06001
Blank	Tetrachloroethene	-1	m	-01	0/00	B UG001
Blank	Ortho- & Para-Xylene	-1	so.	00+	0/00	BUGGOI
Blank	1,1-Dichloroethane	11	5	+00	0/00	B UG001
81 ank	1.1.1-Trichloroethane	ר	4	-01	0/00	B UG001

Ebasco Services Incorporated

Summary of Analytical Results

Rocky Mountain Arsenal Program

Blanks Associated with Task 10 Sanitary Severs -- Rail Yand & Administration

		•	1 1 1 5 6 5 6	A .		
		!	(8		000
Z	1, Z-Dichioroethene	֓֞֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֓֡֡֓֓֓֓֓֡֡֝֡֓֡֓֡֡֡֡֡֓֓֡֓֡֡֡֡֡֡	٧ ،	3 5		
, 0 L 0 .	A. A. D. TOTOTOTOTOTOTOTOTOTOTOTOTOTOTOTOTOTOTO	ا .	•	į) i	
81 8 0k	B-XY1070	ב	10	-01	0 \ 0 0	BUGUUI
Blenk	Chloroform		6	-01	0/00	806001
A lank	Trichloroethene		c	00+	D/01	BUG001
700	Trichlopoethene		i	Ç	0/01	B. 16001
4 1				2	0,01	
Blank	Aldrin	11	'n	- - -	0/00	BUH001
81enk	Atrezine	11	m	-01	0/00	BUH001
Blank	Chlordene	5	8	00	0/00	8UH001
Slenk	Hexach lorocyclopentadiene	ב	•	-01	0/00	BUHDO1
Blank	D-Chlorophenylmethyl Sulfide	-	•	-01	0/00	BUHOO1
Blank	p-Chlorophenylmethyl Sulfoxide	ב	m	-01	0/00	BUM001
81 ank	p-Chlorophenylmethyl Sulfone	ב	m	-01	0/00	BUHDO1
Blenk	Dibromochloropropane	ב	n	-01	0/00	BUH001
Blank	Dicyclobentadiene	-1	-	00+	0/00	BUHDO1
81enk	Vapona	ב	n	00+	0/07	BUH001
81enk	Dilsopropylmethyl Phosphonate	Ľ	-	00+	0/00	BUHDO1
81enk	Oithiene	-	4	-01	0/00	BUH001
8) enk	Dieldrin	ב	۲Ŋ	- -	0/00	BUHDO1
81enk	Endrin	ב	W	- 10-	0/00	BUHDO1
Blenk	Isodrin	-	F)	-01	0/07	BUH001
Blank	Malathion	1	^	-01	0/00	BUHOO1
61enk	1,4-0xethlene	נ	M	-01	0/00	BUH001
81enk	Dichlorodiphenylethene	-	٥	<u>-</u>	0/00	BUH001
Bilank	Dichlorodiphenyltrichloro-	ב	₽D	-01	0/00	BUH001
700.8		-	0	Ş	0/00	
819nk	2-Chloro-1(2,4-Dichlorophenyl)	- 1	•	-0	0/00	BUHDOI
Blank	Bicyclohentadiene	LT	m	-01	0/00	CEMOOI
Blenk	Carbon Tetrachloride	<u>-</u>	eŋ	-01	0/00	CEMDO1
8 Lenk	Chloroform	17	n	٠ 0	0/00	CEMOO1
744		•	•		•	

Note: Blanks are matched to analytical lots by the first three characters in the Sample Number.

Rocky Mountain Arsenal Program

08/02/88

Summary of Analytical Results

Blanks Associated with Tesk 10 Sanitary Sewers -- Reil Yard & Administration

) y De	Analytical Parameters	x	Results		Unita	Number
8 Jenk	Chlorobenzene	7	m	-01	0/00	CEMODA
81enk	Benzene	1	r)	-01	3/00	CEM001
Blank	Oibromoch!oropropene	17	4	7 0-	0/00	CEMO01
Blenk	Dicyclopentadiene	5	n	-01	0/00	CEMOOI
Blenk	Dimethyldiau! fide	ב	•0	ó	0/00	CEMOOI
Blank	Ethylbenzene	ב	P)	-01	0/00	CEMOOI
8) enk	Toluene	1	m	-01	0/00	CEMOOI
Blenk	Methylisobutyl Ketone	ב	m	ö	0/00	CEMOOI
B. ank	Tetrachloroethene	ב	P)	ő	0/00	CEMOOI
Blank	Trichloroethene	-	r)	-01	0/07	CEMBO1
Blenk	Ortho- & Pers-Xylene	ב	P)	-01	0/0n	CEMOO1
81ank	1,1-Dichloroethene	ב	o.	-01	6/60	CEMOO1
8) enk	1,1,1-Trichloroethene	ב	m	Ö	0/07	CEMOOS
Blenk	1,1,2-Trichloroethene	17	m	-01	0/00	CEMODI
81enk	1.2-Dichloroethene	-	P)	-01	0/00	CEMOOI
Blenk	1,2-Dichloroethane	ב	n	-01	0/60	CEMDO1
8 Jank	a-Xylene	LT	^	-01	0/00	CEMOOI
Blank	Vapona	1	'n,	00+	0/00	CEPOOL
Blank	Aldrin	ב	ä	-01	0/05	CEPOOL
Blank	Atrezine	ב	۲,	ņ	0/00	CEPOOL
81enk	Chlordene	ב	.	9	0/05	CEPOOI
3 197k	Hexachlorocyclopentad1ene	7	ø,	-01	0/00	CEPOOI
Blank	b-Chlorophenylmethyl Sulfide	-	o.	-01	0/00	CEPOOI
Blank	p-Chlorophenylmethyl Sulfoxide	ב	ά	-01	0/00	CEPOOL
Blank	p-Chlorophenylmethyl Sulfone	٦	۲,	1 0-	0/00	CEPOOI
81enk	Dibromochloroprobene	7	۶.	-01	0/00	CEP001
51ank	Dicyclopentadiene	11	~	00+	0/00	CEPOOI
Blank	Diisopropylmethyl Phosphonete	ב	-:	Ģ	0/00	CEPOOI
Blank	Oithiane	17	۵,	٠ 1	8/80	CEPOOI
e shir	Dieldrin	L	?	-01	0/00	CEPOOI
81ank	Endrin	11	.	-01	0/00	CEPOOI
Blank	Isodrin	-1	∾.	-01	0/00	CEPOOI

- - -

Ebasco Services Incorporated

Summary of Analytical Results

Rocky Mountain Arsenal Program

Blanks Associated with Tesk 10 Sanitary Severs -- Reil Yard & Administration

		ž	Results	_	Chite	NUMBER
61enk	1.4-Oxethiene	ן	~	-01	0/00	CEPOOI
Blenk	Dichlorodiphenylethene	۲,	n	-01	0/07	CEPOO1
Blank	Dichlorodiphenyltrichloro-	ב		-0 <u>1</u>	0/00	CEPOOI
	ethane					
61enk	Perethion	ב	•0	-01	0/00	CEPOOI
81enk	2-Chloro-1(2,4-D1chlorophenyl)	נ		-01	0/07	CEPDO1
	Vinyldiethyl Phosphates					
61e rk	Mercury		3.1	-05	0/07	CE S001
Blenk	Arsenic		3.1	8	0/00	CEUDO1
Blank	Thiodigiycol	ר	4.2	8	0/00	CEXO01
Blank	Chloroscetic Acid	1	3.5 +01	101	0/00	CEXOO1
81erk	Codmitum	-	7.40	7-	0/00	CEYDO1
Blank	Chromica		1.82	-	0/60	CEYDO1
81erk	Copper		1.11	-	0/00	CEYDO1
Blank	Lead		9.86	-	0/00	CE YOU
61enk	Z1nc		5.08	-	0/00	CEYOO1
81enk	Dimethyldisulfide	11		+01	6/60	CF 8001
Blank	Bicycloheptadiene	ב		-01	0/00	CF BOO1
91enk	Carbon Tetrachloride	-		-01	9/90	CF6001
Blenk	Chloroform	ב		-01	0/00	CF8001
Blank	Methylene Chloride	11	-	90	0/00	CF8001
Blenk	Chlorobenzene	-		00+	0/00	CF6001
Blenk	Benzene	-1	5.	-01	0/00	CF6001
Blank	Dibromochloropropane	-1		00+	0/00	CF8001
Blank	Dicyclopentadiene	1	•	-01	0/00	CF 8001
Blenk	Ethylbenzene	11		٥٠	0/00	CF 8001
81enk	Toluene	ב		-01	0/00	CF6001
81enk	Methylisobutyl Ketone	-	7	-01	0/00	CFB001
Blank	Tetrachloroethene	-		-01	0/00	CF 5001
81 0 7k	Trichloroethene	۲٦	'n	-01	0/00	CF 8001
81 0 nk	Ortho- & Pera-Xylene	5		90	0/00	CF 8001
Blank	1,1-Dichloroethane	ב		00	0/00	CF 8001
818nk	1,1,1-Trichloroethane	1	4	-01	0/00	CFBOO1
11000						

Note: Blanks are matched to analytical lots by the first three characters in the Samble Number.

٠

Ebasco Services Incorporated

Summary of Analytical Results

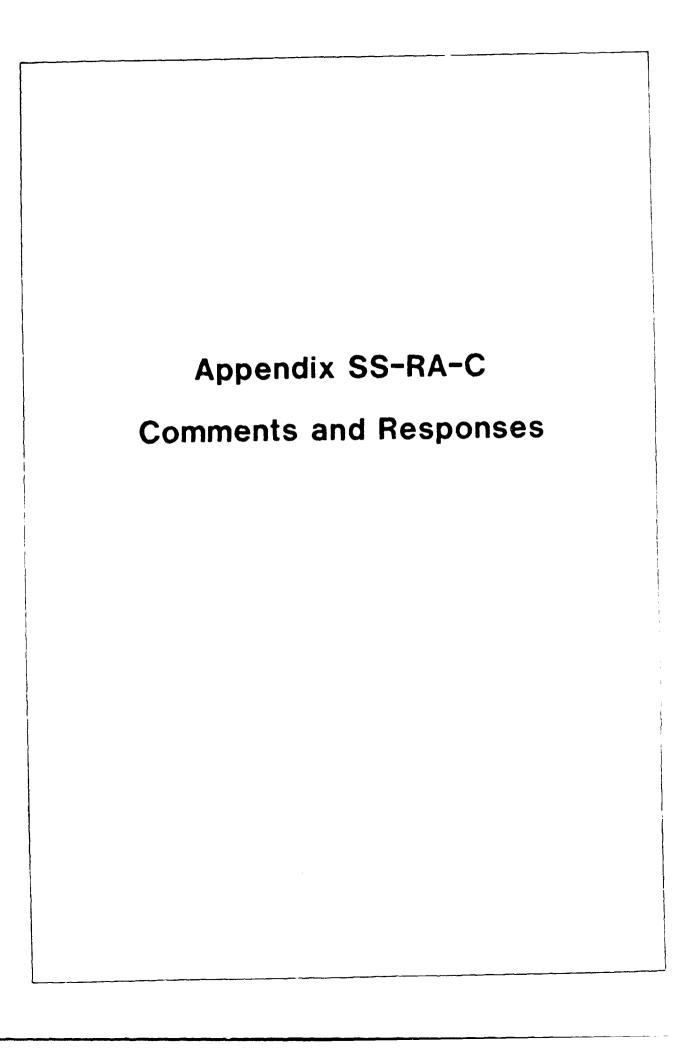
Rocky Mountain Arsenal Program

Blanks Associated with Task 10 Sanitary Severs -- Reil Yard & Administration

Type	Anglytical Paramoters	2	Results		Unita	Sample Number
81erk	1,2-Dichloroethene	LT		00+	0/60	CF 8001
81 ank	1,2-Dichloroethane	-	Ŋ.	-01	0/00	CFB001
81ank	a-Xylene	-1	۲.	1 0-	B/60	CF6001
Blank	Arsenic	-:	8	9	0/00	CFD001
Blank	Isopropylmethyl Phosphonic	<u>-</u>	4	9	0/00	CFF 001
81enk	Aldrin	11	×	-01	0/00	CFK001
B. J. Brok	Atrezine		n	-01	0/00	CFK001
Blank	Chlordane	L	•	-01	0/00	CFK001
Blank	Mexach lorocyclopentadiene		P)	-01	0/00	CFKD01
8 enk	p-Chlorophenylmethyl Sulfide	_	4	80	0/00	CFK001
Blank	p-Chlorophenylaethyl Sulfoxide	5	^	PO+	0/80	CFK001
Blonk	p-Chloropherylmethyl Sulfone	1	٠	-01	0/00	CFK001
Blank	Dibromochloropropane	-	ø	٠ 1	0/00	CFK001
Blank	Dicyclopentadiene	1	4	-01	0/07	CFK001
Blenk	Vapona		M)	-01	0/00	CFKDD1
Blank	Diisopropylmethyl Phosphonate	⊢ ,	n	-01	0/00	CFK001
8 Jenk	Dithiene	1.1	^	00+	0/00	CFK001
Blenk	Dieldrin	LT	M	-01	0/00	CFK001
B) ank	Endrin	ב	×)	1 0-	0/05	CFK001
Blenk	Isodrin	-1	₽)	ō	D/07	CFK001
Blank	Melethion	ב	n	-01	0/00	CFK001
Blenk	1,4-0xathiane	-	•	00+	0/00	CFKD01
Blenk	Dichlorodiphenylethane	5	٣	7	0/00	CFK001
Bienk	Dichlorodiphenyltrichloro- ethane	ב	٠	- 0	0/60	CFK001
81enk	Parathion	-	4	-01	0/00	CFK001
81 ank	2-Chloro-1(2,4-Dichlorophenyl) Vinyldiethyl Phosphates	F 3	n	-01	0/00	CFK001
81 ank	2-Chlorophenol - D4		7.	00+	06/0	CI K002
Blank	1,3-Dichlorobenzene - D4		9	00+	0/00	CFK002
Blank	Di -N-Octyl Phthelate - D4		o.	00+	0/60	CFK002
Blank	Diethyl Ph' Alate - D4		8	00+	0/00	CFK002
700	\(\frac{1}{2} = \frac{1}{2} = \frack{1} = \frac{1}{2} = \frac{1}{2} = \frac{1}{2} = \frac{1}{2} = \f	•			•	

Ebasco Services Incorporated	Rocky Mountain Arsenal Program	08/05/88
Summery of Analytical Results	Blanks Associated with Tesk 10	

Semple Semple Number Results Units Number	C Acid LT 3.5 01 ug/g CFM001 1.6 +01 ug/g CFP001 1.0 +01 ug/g CFP001	4.2 +01 ug/g LT 7.3 -01 ug/g	LT 8.3 +00 ug/g CFP001
Anslytical Parameters	Chlorogeetic Acid	Zinc Zinc Cedmium	Lead
Type	8 18 18 18 18 18 18 18 18 18 18 18 18 18	61erk 61erk 61erk	81ank



Shell Oil Company



c/o Holme Roberts & Owen Suite 1800 1700 Broadway Denver, CO 80290

March 9, 1988

Office of the Program Manager for Rocky Mountain Arsenal ATTN: AMXRM-PM: Mr. Donald L. Campbell, Deputy Program Manager Aberdeen Proving Ground, Maryland 21010-5401

Dear Mr. Campbell:

Enclosed herewith are Shell Oil's comments on the following Draft Final Contamination Assessment Reports:

- Draft Final Phase I CAR, Section 33: Nonsource Area, Task 15, January, 1988
- 2) Draft Final Phase I CAR, Sanitary Sewer Railyard and Administration Areas, Task 10, January, 1988
- 3) Draft Final Phase CAR, Site 36-9, Incendiary or Munition Test Area, Task 14, January, 1988

Sincerely,

(In Hall

C. K. Hahn Manager Denver Site Project

RDL:ajg

Enclosure

cc: (w/enclosure)
Office of the Program Manager for Rocky Mountain Arsenal
ATTN: AMYPM=PP: Mr You'n T. Place, Acting Chief
Aberdeen Proving Ground, Maryland 21010-5401

Office of the Program Manager for Rocky Mountain Arsenal ATTN: AMXRM-TO: Mr. Brian L. Anderson Commerce City, Colorado 80022-2180



cc: Mr. David Anderson
U.S. Department of Justice
Environmental Enforcement Section
Land & Natural Resources Division
P.O. Box 7415
Washington, D.C. 20044-7415

Department of the Army Office of the Judge Advocate General ATTN: Lt. Col. Scott Isaacson Washington, DC 20310-2200

Ms. Patricia Bohm Office of Attorney General CERCLA Litigation Section One Civic Center 1560 Broadway, Suite 250 Denver, CO 80202

Mr. Jeff Edson Hazardous Materials and Waste Management Division Colorado Department of Health 4210 East 11th Avenue Denver, CO 80220

Mr. Robert L. Duprey
Director, Hazardous Waste Management Division
U.S. Environmental Protection Agency, Region VIII
One Denver Place
999 18th Street, Suite 500
Denver, CO 80202-2405

Mr. Connally Mears
Air and Waste Management Division
U.S. Environmental Protection Agency, Region VIII
One Denver Place
999 18th Street, Suite 500
Denver, CO 80202-2405

Mr. Thomas P. Looby Assistant Director Colorado Department of Health 4210 East 11th Avenue Denver, CO 80220

RESPONSES TO COMMENTS OF SHELL OIL COMPANY ON DRAFT FINAL CONTAMINATION ASSESSMENT REPORT SANITARY SEWER - RAILYARD AND ADMINISTRATION AREAS

Comment 1: Page 11, first full sentence.

Very high chloride levels were measured in alluvial Well 34002 (ESE, 1986b/RIC 86317R01).

Response: Groundwater data gathered by ESE in 1986 show chloride concentrations ranging from 103 ppm to 122 ppm in Well 34002, located approximately 2,000 ft downgradient from the former housing area. Comparable levels of chlorides (95.1 ppm to 145 ppm) were found in Wells 02008, 03005, and 34008, located both upgradient and downgradient of the sanitary sewer system. Based on these data, it does not appear that the sanitary sewers are contributing to chloride levels in groundwater in the railyard and administrative areas.

Comment 2: Page 11, first full paragraph.

Chlorobenzene and dichloroethylene were also measured in Well 35012.

Response: Chlorobenzene and trichloroethylene (not dichloroethylene) were also measured in Well 35012. The text will be changed to indicate the presence of these compounds in Well 35012.

Comment 3: Page 15, third full paragraph.

The Black and Veatch investigations identified suspected infiltration points in the vicinity of manholes 47, 58, 59, 60 and 62. Why were none of these included in the inspection?

Response: The Black and Veatch investigations (1979) indicated that segments of the sewer line in the vicinity of these manholes were potential sources of inflow into the sewer system. These conclusions were based on observations of smoke emanating from prairie dog holes during the smoke testing operations segment of their investigation. These prairie dog holes were apparently located along the alignment of the sewer line. However, points of infiltration, especially points on the crown of the sewer, are not necessarily points of exfiltration. Contamination of soil associated with the sewer line would be from points of exfiltration and not points of infiltration.

Additionally, the Black and Veatch investigations did not indicate these manholes to be in poor condition. Manholes 50 and 65, located in the vicinity of the questioned manholes, were identified as being in poor condition. These manholes were included in the Task 10 investigations.

Comment 4: Page 30, first sentence.

"Dibromochloropropane was handled in the railyard area..."

It is unclear what is meant by <u>handled</u>. With respect to dibromochloropropane, Shell does not believe that any activity occurred at this site other than the storage of railcars.

Response: The text will be changed to clarify that based on all information reviewed to date, dibromochloropropane was stored in rail cars in the railyard (Adcock, 1980) and shipped from the railyard area (Sheppard, 1981).



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY REGION VIII

999 18th STREET - SUITE 500 DENVER, COLORADO 80202-2405

Ref: 8HWM-SR

MAY 0 3 1989

Colonel W. N. Quintrell Program Manager AMXRM-EE Department of the Army U.S. Army Toxic and Hazardous Materials Agency Building 4460 Aberdeen Proving Ground, Maryland 21010-5401

Re: Rocky Mountain Arsenal (RMA), Task 10, Draft Final Contamination Assessment Report, Sanitary Sewer, Railyard and Administration Area, January, 1988.

Dear Colonel Quintrell:

We have reviewed the above referenced report and have the enclosed comments from our contractor. Our contact on this matter is Mr. Connally Mears at (303) 293-1528.

Sincerely yours,

Robert L. Duprey, Director Hazardous Waste Management

Division

Enclosure

cc: Thomas P. Looby, CDH
 David Shelton, CDH
 Lt. Col. Scott P. Isaacson
 Chris Hahn, Shell Oil Company
 R. D. Lundahl, Shell Oil Company
 Thomas Bick, Department of Justice
 David Anderson, Department of Justice
 Preston Chiaro, EBASCO

RESPONSES TO COMMENTS OF U.S. ENVIRONMENTAL PROTECTION AGENCY ON DRAFT FINAL CONTAMINATION ASSESSMENT REPORT SANITARY SEWER-RAILYARD AND ADMINISTRATION AREAS

Comment 1: Page 29. Last Paragraph and Page 32. Follow-on Investigations. Although sampling was conducted at "worst case" manholes, the possibility that "considerable infiltration" may have taken place due to the "poor condition" of the line (page 29, third paragraph) necessitates that more sampling be conducted underneath broken and leaking sections of the line. This contention is based on the discovery of chloroacetic acid and/or dibromochloropropane in grab samples from the line sediments (manholes R29, H3, and G5). Therefore, it is recommended that during the feasibility study samples be collected under damaged portions of the line. Also, because their presence was "not anticipated" further historical research should be conducted to locate the sources of pesticides in the line.

Response:

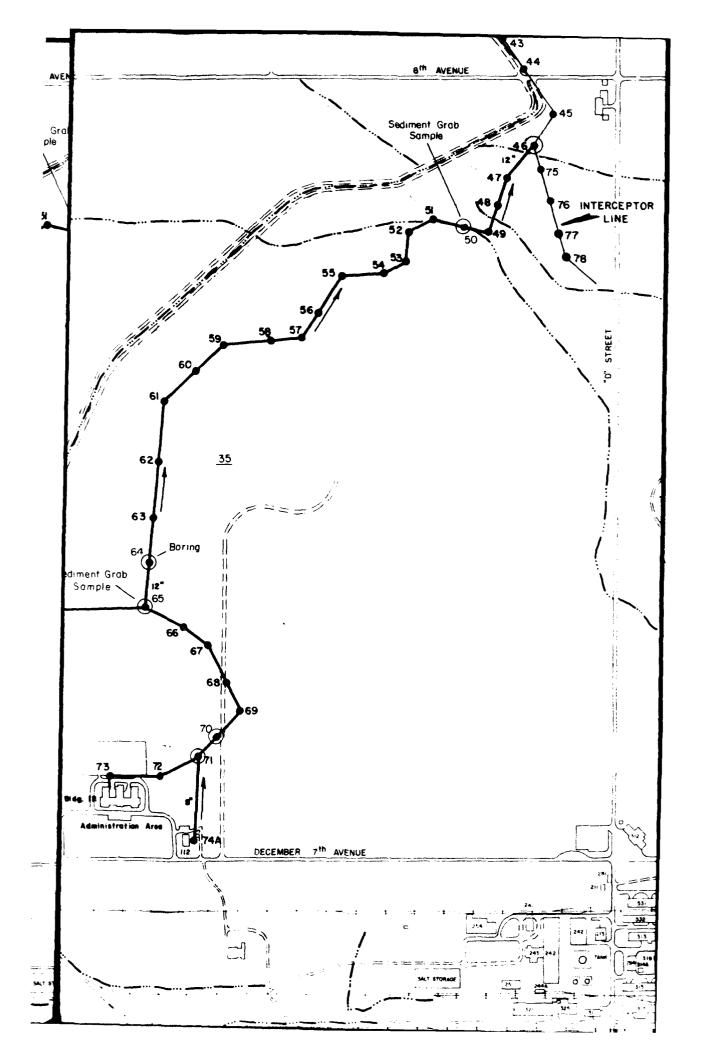
The primary issue raised by this comment is whether contaminants potentially within the sewer have exfiltrated to the surrounding soils. Chloroacetic acid was found in grab samples from Manholes H2, R29, and 65. Chloroacetic acid is highly soluble in water and was therefore most likely a recent addition to the sewer system. If this compound was present previously it would have been washed away by the flow in the sewer. It is not likely that additional investigations will identify this compound outside of the sewer unless the pipe is leaking at the time of sampling.

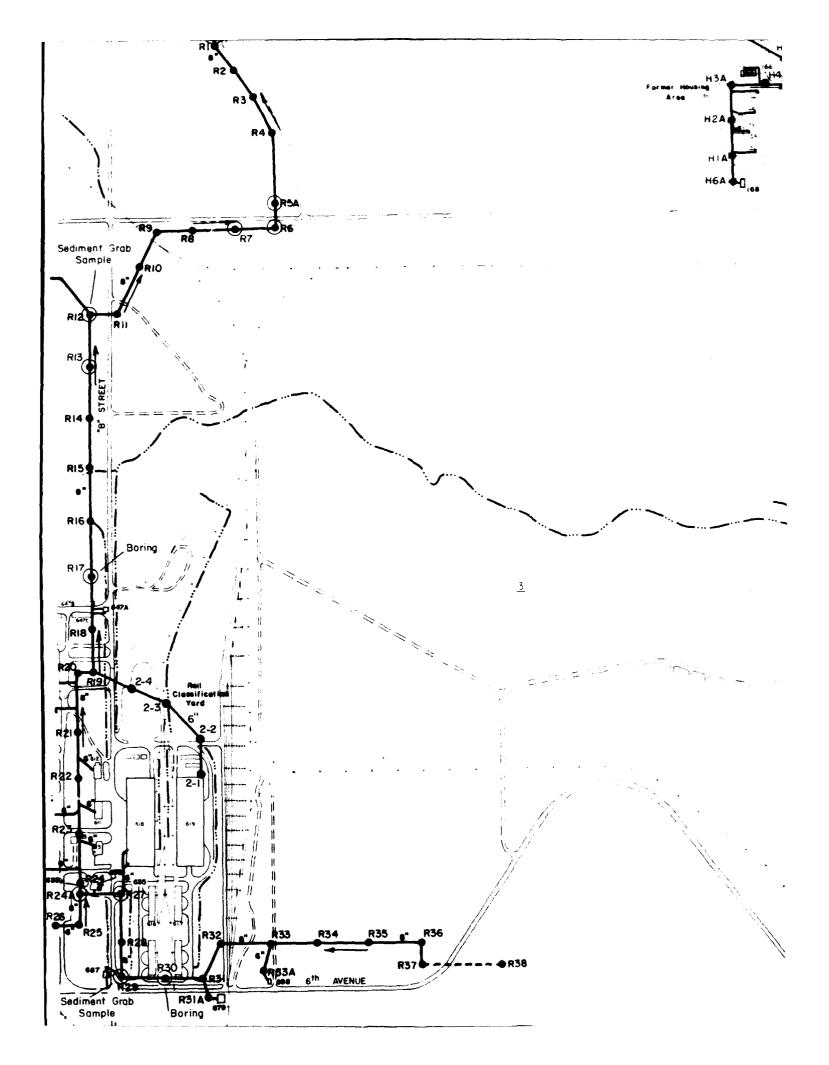
Dibromochloropropane was found in grab samples from Manholes 50 and 65 in the administration area. This compound is less water soluble and therefore much more likely to still exist in areas where it was found.

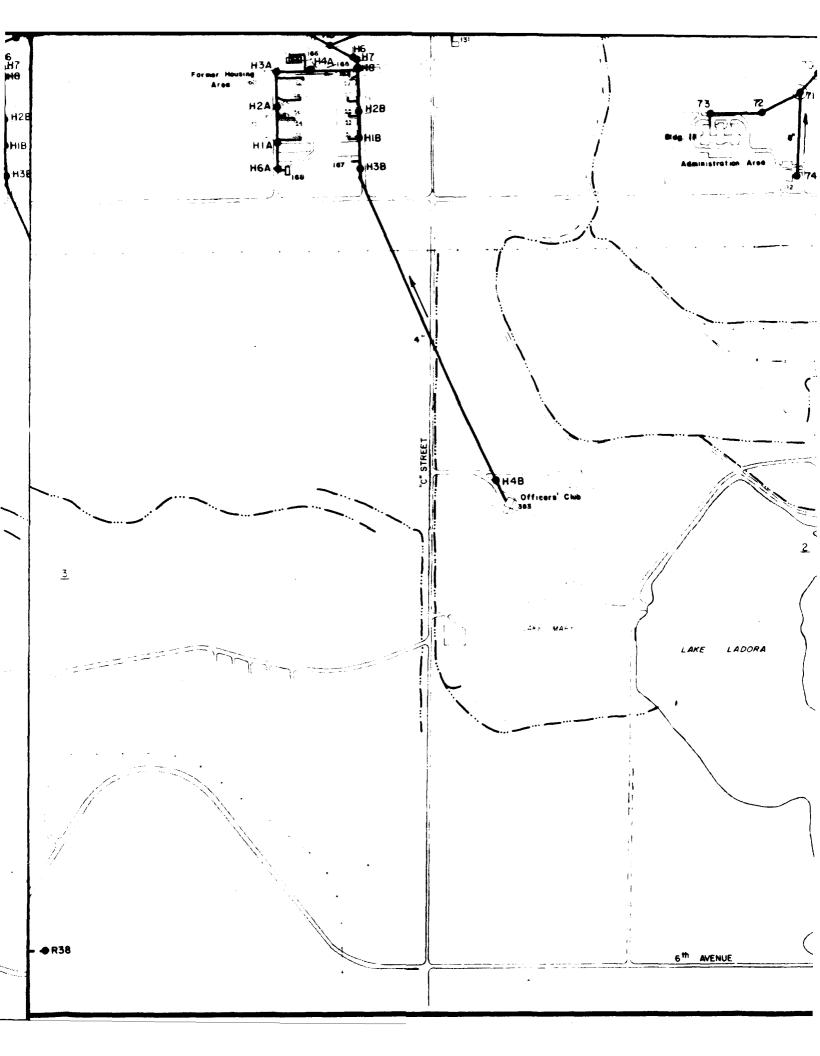
A follow-on investigation has been recommended if the Feasibility Study determines that additional information on the migration of dibromochloropropane from the sewer is needed. It has also been recommended that the samples be analysed for chloroacetic acid to determine if it is present in the soils surrounding the pipe. Sections 3.2.5 and 3.3 have been changed accordingly.

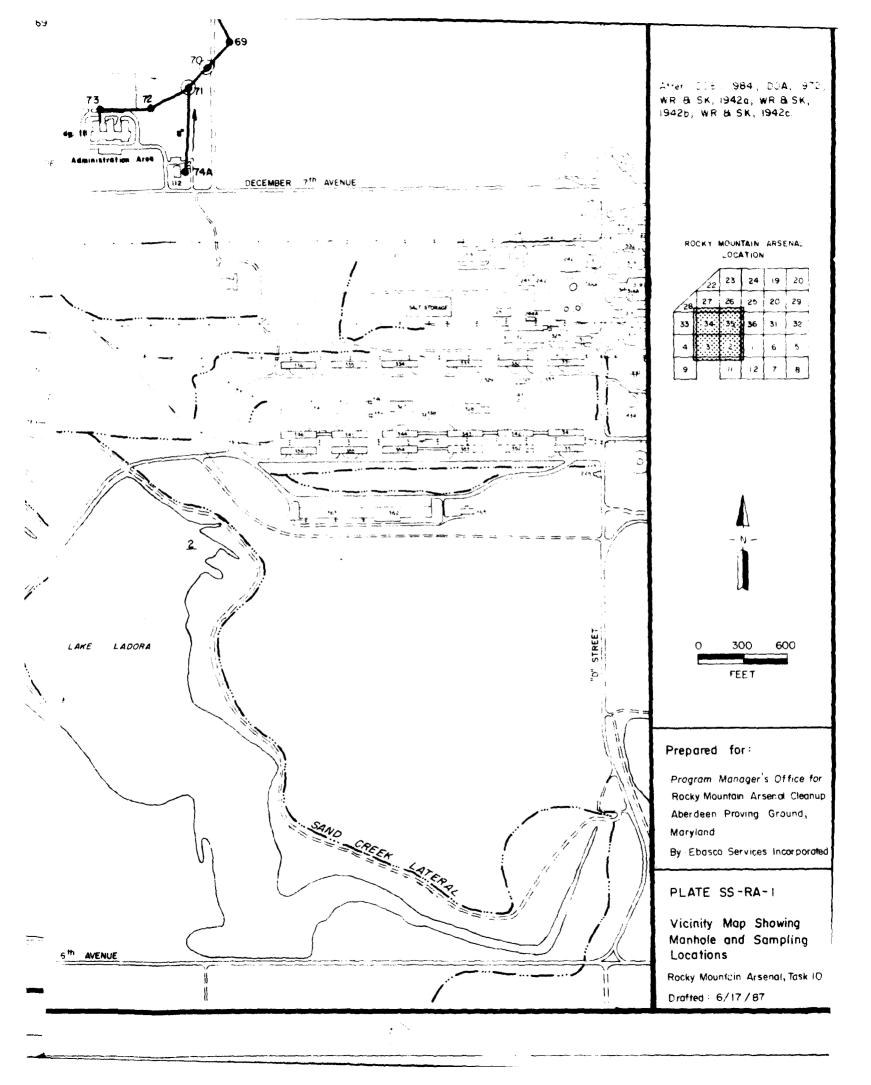
RESPONSES TO COMMENTS OF COLORADO DEPARTMENT OF HEALTH ON DRAFT FINAL CONTAMINATION ASSESSMENT REPORT SANITARY SEWER - RAILYARD AND ADMINISTRATION AREAS

No comments received.

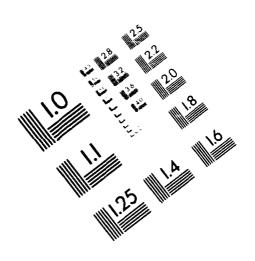








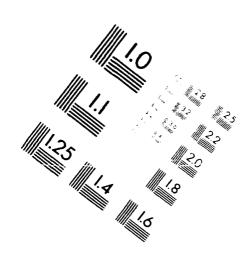
AD-A272 093 UNCLASSIFIED NL END FILMED DTIC

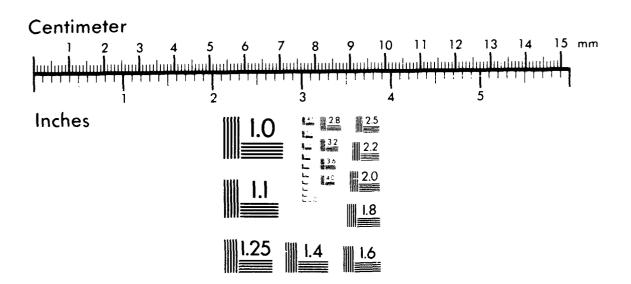


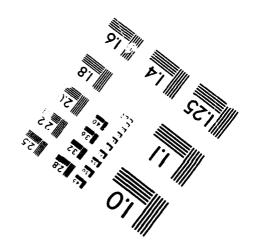


Association for Information and Image Management

1100 Wayne Avenue Suite 1100 Silver Spring, Maryland 20910 301:587-8202







MANUFACTURED TO AIIM STANDARDS BY APPLIED IMAGE, INC.

